THE TRAINING OF MILITARY PILOTS:

MEN, MACHINES, AND METHODS

BY

MICHAEL D. HAYS

A THESIS PRESENTED TO THE FACULTY OF

THE SCHOOL OF ADVANCED AIRPOWER STUDIES

FOR COMPLETION OF GRADUATION REQUIREMENTS

SCHOOL OF ADVANCED AIRPOWER STUDIES

AIR UNIVERSITY

MAXWELL AIR FORCE BASE, ALABAMA

JUNE 2002

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
00 JUN 2002	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Training Of Military Pilots: Men, Machines, And Methods	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air University Maxwell Air Force Base, Alabama**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**UU**	**67**	

DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

ABOUT THE AUTHOR

Major Michael D. Hays is a graduate of Pennsylvania State University and was commissioned through Officer Training School in 1988. Graduating from Specialized Undergraduate Navigator Training in 1989, he was assigned to the EC-130 in Germany and participated in the Gulf War. In 1992, Major Hays was selected for Undergraduate Pilot Training. Earning his wings in 1993, he went on to fly the F-16 at Hill AFB, Utah and later instructed at Luke AFB, Arizona. Major Hays is a senior pilot with over 1300 hours. He has a bachelor's degree in Aerospace Engineering from Pennsylvania State University and a master's degree in Military Art and Science from Air University at Maxwell AFB, Al. Major Hays was assigned to the USAFE staff after completing SAAS.

ACKNOWLEDGEMENTS

I would like to acknowledge several people for their support and guidance. I want to thank my advisor, Colonel Stephen Chiabotti, for suggesting the topic and for his patient insights. I also thank Dr. Harold Winton for his expert guidance on the structure and mechanics of the argument.

Most importantly, I want to express my sincere appreciation to my wife, Susanne, and son, Clayton for their love, patience, and understanding during my efforts to complete this project.

ABSTRACT

This study analyzes strategic issues in Air Force undergraduate pilot training (SUPT). After describing the key variables that determined pilot training's historical development, the author assesses what type of training system, generalized or specialized, produces the best ratio of cost to effect. The conclusion is that the current specialized system is more responsive to disparate operational needs, better matches training media to task, and generates large cost savings for the Air Force. Next, the writer evaluates recent structural changes to SUPT and analyzes the pilot training systems of the US Navy and Israeli Air Force. Several broad conclusions emerge from these inquiries: the need to stabilize the still-maturing SUPT system; the potential benefits of improved candidate pre-selection methods; and, finally, the pivotal role of the instructor pilot in any training program's success. The final chapter synthesizes the study's findings and implications to suggest an optimal course for future Air Force pilot training.

CONTENTS

Illustrations

Figure

Chapter 1

Introduction

Undergraduate Pilot Training (UPT) is arguably the U.S. Air Force's most significant training program. Beyond its purely technical function, UPT has become both a cultural rite of passage and the institutional portal through which most Air Force leaders pass. While frequently modified, the program has undergone few fundamental changes during its history. Two overriding training methodologies have emerged: a generalized training system and the current specialized training system. In a generalized system, all students, regardless of future assignment, fly the same aircraft and follow the same syllabus from start to awarding of wings. Under a specialized approach, after a common initial phase, students are placed in "tracks" which use aircraft and syllabi specifically tailored to their future assignment.

Over the last decade, the Air Force has made several structural changes to UPT. In addition to implementing a specialized system (SUPT), the Air Force has, for example, changed its screening program, transformed the composition of its instructor force, and instituted joint pilot training with the US Navy. The Air Force needs a training system that will continue producing the world's finest pilots in order to sustain its dominance into the 21st century. This study examines strategic issues in the Air Force's undergraduate pilot training system and seeks answers to the following questions: 1.) Which system, generalized or specialized, produces the best ratio of cost to effect over the life cycle of a pilot? 2.) What has been the effect of recent structural changes in the pilot training system? 3.) What can the Air Force learn from the pilot training experiences of two other technologically comparable air forces? And 4.) What system will best serve the Air Force's future needs?

The study begins with a historical analysis of pilot training's first 50 years—from its roots in the pre-World War I US Army up to the Air Force's decision to implement generalized, all-jet UPT in the late 1950s. Several themes and patterns emerge. In the absence of an official training doctrine to guide its early development, pilot training evolved from a variety of factors. The history reveals that increasingly diverse

operational roles and missions, wartime production demands, aircraft availability, and precedent all played a role in pilot training's evolution. Unquestionably, from before World War I to the present, pilot training in the U.S. Army, and later the U.S. Air Force, has to be considered a success story. The staggering production demands of World War I and II were met, of necessity, through the use of a specialized, large-scale training pipeline. After the post-World War II force reductions, the newly formed, independent Air Force kept this basic training construct in place with students branching into "fighter" or "multi-engine" tracks after a common initial phase.

In the late 1950s, however, a combination of factors contributed to the Air Force decision to implement a generalized, all-jet training program using the newly acquired T-37 and T-38 trainers. This generalized program became a part of Air Force culture and remained in place for over 30 years. During that time, Instructional Systems Development (ISD) emerged as the Air Force's basic training doctrine. Chapter Three explains the ISD concept, outlines its development, and traces its influence on the Air Force's decision to return to a specialized approach to pilot training. Some tension existed between generalized training and ISD principles. This tension, along with T-38 service life concerns, produced a great deal of official research into a return to specialized, or "tracked," pilot training. The research findings were nearly unanimous in their advocacy of a more specialized approach.

The deliberations spawned by these studies, the momentum of ISD, and the more proximate T-38 life-cycle concerns ultimately led to the implementation of Specialized Undergraduate Pilot Training (SUPT) in the early 1990s. SUPT is essentially a return to the pre-1960 approach. Students fly a common initial phase in the aerobatic T-37 before entering one of four tracks: the Tanker/Transport track in the newly acquired T-1A (a business jet derivative), the Fighter/Bomber track in the T-38 (a fighter-like aircraft), the turboprop track (joint training in the US Navy T-44, a twin-turboprop aircraft), or joint helicopter training with the US Army in the UH-1. SUPT has now been in place for nearly a decade—sufficient time to begin drawing useful comparisons with generalized UPT in order to determine which system optimizes cost to effect. Several criteria will be used to make this determination: adherence to ISD principles; program costs; responsiveness to operational, or "customer," needs; and effects on force structure

flexibility.

A variety of sources will provide the necessary evidence. AETC (and earlier, Air Training Command [ATC]) conducts regular field surveys to gather feedback on its product. A comparison of these survey results over time yields valuable insights into the strengths and weaknesses of the different approaches. Program costs are compared to determine if savings from SUPT have, in fact, materialized. Also, a task analysis of the various syllabi provides useful data on the responsiveness of the two approaches to operational needs. Finally, personnel management statistics for the rated force will determine what effect, if any, SUPT has had on force-structure flexibility.

SUPT itself is still a maturing system. Chapter Four explains the genesis and effects of two recently implemented structural changes to that system, both of which were precipitated by external conditions and events. After the 1997 grounding of the entire fleet of T-3A Enhanced Flight Screeners, the Air Force's screening program was in disarray. The newly implemented program, Introductory Flight Training (IFT), requires that prospective students earn a private pilot license from a civilian flying program prior to entering SUPT. In what constitutes another systemic change, Air Force Reservists now comprise a large percentage of the SUPT instructor force. The number of active-duty instructors with operational experience, conversely, has dwindled. The chapter examines the net effect of these two initiatives on the health of SUPT.

Chapter Five broadens the analytical scope and seeks insights from the pilot training systems of two technologically comparable air forces: the US Navy, and the Israeli Air Force (IAF). Both these services have long-standing, high-quality training programs. The Navy and Air Force programs developed in parallel, but remained separate dating back to their pre-World War I roots. Under contextual influences similar to those affecting the Air Force, the Navy has used a specialized system since World War II. Significantly, the Air Force and Navy have recently begun joint procurement of a primary trainer, the T-6A, and introduced joint pilot training (JSUPT) into some segments of their respective programs. The chapter evaluates whether or not this program warrants expansion.

The study of Israeli pilot training is particularly valuable in light of the IAF's combat performance and the demands placed on its training system due to the country's

geopolitical situation. While there are obvious contextual factors separating the IAF and USAF systems, many of the principles underpinning the Israeli system are transferable. For example, the rigor of the IAF's candidate selection and screening processes has particular relevance for the USAF. Also, in light of recent economic measures affecting SUPT instructor manning, the composition and operational focus of the IAF instructor force may yield some valuable insights.

Chapter Six concludes the analysis by summarizing the answers to the strategic questions posed at the outset. This last chapter also synthesizes those answers in order to chart a future course for Air Force pilot training. The analysis begins, however, with the past—specifically, pilot training's first 50 years.

Chapter 2

Pilot Training's First 50 Years:
A Legacy of Specialization

In 1909, military pilot training in the United States consisted of a single airplane and one instructor.[1] For nearly a century since that humble beginning, the U.S. armed forces consistently produced highly competent aviators. The training system responsible for this success endured massive expansions and contractions, met the needs of two world wars and several regional conflicts, and adapted itself to multiple technological and doctrinal changes. In spite of this tumult, a historical analysis of that system reveals remarkable continuity in training philosophy and methodology. This chapter traces pilot training's evolution from its Army roots, describes the historical factors and influences that shaped modern U.S. Air Force pilot training, and identifies the key variables that determined the use of either a generalized or specialized approach.

Many of the factors that shape modern pilot training today date back to the Wright School in Dayton, Ohio. The sequential approach to pilot training began there with students starting out in ground school, progressing to flights with an instructor (often Orville Wright himself), and eventually being "cleared solo" in the Wright two-seat trainer.[2] The precedent of phasing students through progressively more advanced aircraft also began in the pre-World War I era—by 1913, these phases crystallized into "primary," "basic," and "advanced" training, which became fixtures in the U.S. training system.[3] Establishing another precedent that persists today, newly graduated pilots frequently gave instruction to in-coming students. Henry "Hap" Arnold was one such student in a two-man class in 1911. After ten days of supervised flying, he observed that "my instruction under the personal supervision of the instructor in the machine is finished

---

[1] Rebecca Hancock Cameron, *Training to Fly, Military Flight Training 1907-1945,* Air Force History and Museums Program, 1999, p. 26.
[2] Frank P. Lahm, "*Training the Airplane Pilot,"* Journal of Royal Aeronautical Society, Nov 1933, p. 915, 167.401-4, AFHRA.
[3] *"A Pictorial History of Kelly Air Force Base,"* Office of History, Air Force Logistics Command, 1987, p. 14.

and from now on all my flights will be made alone for experience."[4] The rival Curtiss school initially used only single-seat trainers; but after experiencing several student crashes and realizing the value of having an instructor on board, it too adopted the two-seat approach.

Emerging army aviation doctrine also dictated the use of two-seat trainers. The flying school's name, Signal Corps Aviation School, reflected the fact that observation was the only recognized military role for aircraft at the time. Establishing the connection between training and doctrine, the Army's Chief Signal Officer, arguing for two-seat trainers, stated that "for military purposes it has been conclusively shown that the two-place machine is necessary for reconnaissance purposes."[5] In fact, many early trainers were simply modified operational aircraft. Dictated by budgetary constraints, limited production capacity, and no systematized procurement plan, this practice was not popular among flying instructors: "...satisfactory results in training can be obtained only by using the proper kind of training machine...this makeshift policy is one that ought not to be followed."[6] Acquiring new combat aircraft, however, would continue to take budgetary priority over the acquisition of dedicated trainers.

Personnel challenges were frequently as significant as those in training equipment. Prior to World War I, very few army officers were allowed to enter the aviation career field. The Aeronautics Division of the War Department established criteria designed to enhance the likelihood of an applicant's success in flight training.[7] Among the desired characteristics were "physical skill and a natural aptitude for balancing and judging distances properly," noting that "a person who does not possess these attributes can be trained...but will never become really proficient."[8] Tests of equilibrium sensitivity, reaction times, and visual fields were typically conducted in order to determine qualifications. Because piloting proved to be as much art as science, the difficulty, then as now, was finding measurable indices, short of actually piloting an aircraft, that accurately determined an individual's flying potential. Training officers also

[4] Wkly Rprts, Milling and Arnold to Chief Signal Officer, 27098, RG111, NA, as found in Cameron, p. 63.
[5] Annual Report, Chief Sig Off Army to Secy War, 1911, 24, entry 58, RG 111, NA, as found in Cameron, p. 44.
[6] Cowan rprt to Chief Sig Off, Aug 9, 1915, RG 111, NA, as found in Cameron, p. 63.
[7] Lahm, p. 920.
[8] Memo to Chief Sig Off, Aug 15, 1911, 28227, RG 111, NA, as found in Cameron, p. 54.

recognized quickly the importance and difficulty of finding good flight instructors—"expert aviators are not necessarily competent instructors." In a similar statement regarding instructors that remains valid today, the Signal Corps Aviation School commander commented that "men who can do this work and do it well are very rare, and their services are cheap at almost any price."[9]

More than the instructors would be put to the test when America entered World War I. In spite of the prewar developments, the entire training system, still in its infancy and lacking a standardized or centralized process, was not prepared to meet the war-time demand for pilots.[10] Instruction before the expansion was highly personalized to meet individual student needs—the small scale of the enterprise facilitated this tailored approach. At the war's outbreak, pilot training was just beginning to adapt itself to the new roles and missions for aircraft—pursuit and bombing, for example—emerging from Europe. In fact, even before the war began, in a report to Congress, the Signal Corps recommended a rapid expansion in personnel, equipment, and training facilities. Several regional training centers were proposed, with new subjects such as "the dropping of projectiles from aircraft" being taught.[11] In an adaptation of the European system, pilots were placed into either "pursuit," "observation," or "bombardment" tracks after completing their early phases in general-purpose trainers.[12] Introducing specialization into the training system was simply a logical response to an increasingly complex and diversified wartime role for aircraft.

The classification process spawned the inevitable rivalries between different flying communities that remain in place today. A post-war statement by Air Service Director, Maj. Gen. Charles Menoher, explained how a student's "track" was determined: "At no time was the selection of the kind of training a cadet was to take left to his choice. It might have been considered, but...his suitability for the work...decided his classification."[13] Stereotypes were established early. Pursuit pilots should be young and aggressive, and have "initiative and quickness of perception." Desired traits for

[9] Memo to Chief Sig. Off, Sept 26, 1914, 35718, RG 111, NA, as found in Cameron, p. 62.
[10] Lois Walker and Shelby Wickam, "*From Huffman Prairie to the Moon: The History of Wright Patterson Air Force Base,"* Office of History, Air Force Logistics Command, 1984, p. 20, K289-92.158, AFHRA.
[11] "Military Aviation," 62nd Congress, 2nd session, HR 718, Apr 26, 1912, as found in Cameron, p. 73.
[12] Cameron, p. 107.
[13] Memo, Maj. Gen. Menoher to Chief of Staff, Apr 21, 1919, Box 620, 353.9, entry 166, RG 18, NA, as found in Cameron, p. 131.

observation pilots were maturity, attention to detail, and an interest in "military tactics and maneuvers." Bomber pilots, on the other hand, should be older with a "good sense of navigation and expert at cross-country flying."[14] Notwithstanding these efforts to identify and match capabilities with aircraft, in practice, manpower requirements at the front often determined a new pilot's assignment.

Adding to the friction and tumult associated with war-time production, the Air Service conducted pilot training both at home and abroad.[15] This was a practical necessity. The large-scale training programs already in place in France and Britain could more easily accommodate the rapidly growing number of trainees than could the American-based establishment. Also, America simply could not yet produce sufficient aircraft (particularly the specialized variety) to sustain all training at home. Over three-fourths of the aircraft flown by U.S. Air Service pilots were built in Europe. The Curtiss "Jenny" primary trainer (see Figure 1 below), however, was a wartime success story, with 600 of the two-seat biplanes being delivered by the end of 1917.[16] While older combat aircraft were eventually designated to fill training needs, they could not, in fact, be spared from the front.

[14] Memo from Chief of Training, Office of Dir. Mil Aero, to Comdg Offs, all Flying Fields, Aug 23, 1918, entry 206, RG 18, NA, as found in Cameron, p. 131.
[15] Maurer, *"Aviation in the U.S. Army, 1919-1939,"* General Histories, USAF Historical Research Center, Washington D.C., 1987, p. xxii.
[16] Ibid., p. xxi.

Figure 1: Curtiss JN-4 "Jenny" World War I Trainer

Source: Photo courtesy of USAF Museum

The result, both at home and abroad, was training aircraft that were too few in number and bore little resemblance to the combat aircraft that trainees would eventually fly. Training officers, such as the head of the Flying Training Department in England, Capt G. J. Dwyer, saw the importance of acquiring trainers that closely approximated tactical aircraft. To improve efficiency, he also suggested that a pilot "be trained as a specialist all through rather than given a general training with a specialist finish."[17] This suggestion presaged the USAF decision 70 years later to adopt SUPT. As it was, most primary training was conducted stateside and most advanced training was done overseas; and pilots usually flew a variety of different aircraft in a system that never became fully standardized.

At the time of the armistice, the Air Service planners' vision of conducting all wartime pilot training in the United States was still beyond reach. A shortage of machines and qualified instructors, delays in transition training, organizational growing pains, and the fact that military aviation was less than a decade old all contributed to the training system's inability to meet production demands.[18] Many pilots were thrown into combat units with insufficient training, while others got caught in training logjams and

[17] Lessons learned from British System of Training, in Report on the Air Service Flying Training Department in England, Gorrell, as found in Cameron, p. 160.
[18] Memo from Maj. Gen. Menoher, Dir. Air Svc., to Chief of Staff, Apr 21, 1919, box 620, 353.9, entry 166, RG 18, NA, as found in Cameron, p. 195.

never saw action after earning their wings. Nevertheless, by war's end, with over 30 stateside "flying fields" in operation and several more overseas, the U.S. Air Service had achieved much, graduating over 17,000 pilots.[19] War-time problems were due more to production shortfalls and other factors than any failure to grasp the subtleties of training men to fly. Many features of modern pilot training have their roots in this first decade of manned flight. Most importantly, early Air Service leaders saw the need for both a large, standing aviation industry and a standardized training system to meet the needs of a future national emergency.

During the early inter-war period, army aviation leaders standardized the training processes developed during the war and established the framework of a system that would ultimately meet the demands of the next war. Tight budgets, however, continued to prevent acquisition of more advanced training aircraft, which necessitated the use of World War I era models well into the 1920s. Pilot production during the 1920s and 30s stabilized at a few hundred men annually, and a one-year program (made up of three, four-month stages) emerged.[20] After the primary and basic stages, students were "tracked" into pursuit, attack, bombardment, or observation specialties. After earning their wings, pilots would report to their respective operational units to gain proficiency in their assigned aircraft. Army aviation leaders also convened several commissions during this period to analyze training effectiveness and propose improvements to the system. In what would be paralleled over a half century later, discussions revolved around the benefits of generalized vs. specialized approaches to pilot training.

As Chief of the Training and Operations Division, Carl Spaatz suggested a more generalized training plan with "less emphasis on particular types of aviation."[21] Spaatz thought that associating too closely with a particular aviation branch might erode institutional cohesion. A more generalized approach also supported the trend toward standardization because a single, common trainer could serve as a platform for the various advanced phases. This idea persisted into the 1930s, but aviation's increasingly specialized roles caused the Air Corps to discard it in favor of tracking pilots into distinct

[19] Edgar S. Gorrell, *The Measure of America's World War Aeronautical Effort,* Lane Press, Burlington, Vt., 1940, p. 14.
[20] ATC Histories, History of AAF Training Command 1 January 1939-VJ Day, p 494, K220.01, Vol. 4, AFHRA.
[21] Cameron, p. 259.

specialties after they completed the primary and basic phases.[22] During World War I, the Training Command actually wanted to begin specialization earlier, during the basic phase; but it could never procure sufficient twin-engine trainers to implement such a policy.[23] The common, early phases taught fundamentals and assessed capabilities in standard aircraft. Most attrition occurred in the early phase before a large training investment had been made. This approach would remain in place throughout the inter-war period and be expanded to meet the massive demands of the coming war. As the potential for U.S. involvement in that war increased in the late 1930s, aircraft and pilot production numbers skyrocketed.

Success in meeting production demands was due largely to the actions of experienced Air Corps leaders such as Hap Arnold and "Tooey" Spaatz. These men knew from their World War I experience that rapidly expanding to a large-scale training program would be an important and difficult task. While the politicians and industrialists focused on aircraft production numbers, Arnold realized that "it was just as essential to have a balanced production of trained combat and maintenance crews as it was to have planes."[24] Spaatz echoed this awareness after a trip overseas to inspect British training bases. He assessed the training pipeline as being "the neck of the bottle."[25] Aircraft production numbers drove the required number of pilots, and early prewar estimates projected a need for 30,000 pilots a year. Actually, in its peak year of 1944, the Army Air Forces produced an astronomical 86,578 pilots.[26] Strategic pre-war decisions made this growth possible.

In October 1938, Arnold foresaw the looming manpower shortfalls and, capitalizing on his close ties to civilian aviation leaders, established the policy that the primary phase of training would be conducted at civilian schools using mainly civilian instructors.[27] Congress quickly ratified this pragmatic decision; and by July 1939, nine of these civilian schools were conducting primary training.[28] By 1943, 56 of these civilian schools were in operation. In May 1940, a further effort to boost pilot production

[22] Ibid.
[23] Craven and Cate, *Men and Planes,* p. 571, as found in Cameron, p. 400.
[24] Henry Arnold, *Global Mission,* Harper, New York, 1949, p. 205.
[25] Cameron, p. 313.
[26] AETC History Office, "Pilot Production Numbers," www.aetc.af.mil.
[27] ATC Histories, January 1939-August 1945, pp. 484-485, K220.01 Vol. 3, AFHRA.
[28] Ibid.

resulted in the three 16-week stages from the inter-war period being reduced to 10 weeks each, shaving nearly five months off the previous program.[29] These training stages would be further reduced to nine weeks each in 1942.[30] Ground school and flying hours were reduced to meet the time requirements. The guidance from Air Corps leaders was that "any duties and training...not contributing directly to the attainment of combat efficiency be held to an absolute minimum."[31] Of necessity, the training program used "assembly-line" methods not unlike those being used in industry.

After completing the primary stage (which had nearly a 30% attrition rate) at a civilian school, students progressed to the basic stage. Military personnel controlled this stage, which introduced students to higher performance aircraft and flight maneuvers. A student's performance in the basic phase determined which advanced track he was to enter. The advanced stage would then provide specialized instruction in an appropriate aircraft for pursuit, bombardment, attack, or observation. Training officials stressed the importance of advanced trainers for this phase to match the performance and handling characteristics of combat aircraft. A chronic shortage of aircraft, however, reduced this concept to either a single-engine or twin-engine advanced stage. Approximately two-thirds of students were designated for the twin-engine track.[32]

Sufficient twin-engine trainers were not available, however, until after the war started, which caused many students to fly only single-engine types through the entire advanced stage regardless of their future assignment.[33] This, in effect, became a generalized program for these students. After graduating, pilots generally entered "transition" training for their specific aircraft. This practice essentially added another phase to the training pipeline and prepared pilots to join their operational units.

Another key component in the overall training system was the role played by the military instructor pilots. The precedent set at the Wright School of retaining new pilot graduates for instructor duty became established policy throughout the war.[34] The

---

[29] Craven and Cate, eds., *Men and Planes,* 458; Hist, Central Flying Tng Comd.
[30] ATC Histories, January 1939-August 1945, K220.01 Vol. 3, p. 513, AFHRA.
[31] Memo from Maj C.E. Duncan, Exec Ofc Chief Corps, to Comdg Gen GHQ Air Force, Apr 25, 1940, box 178, 353.9, AAG, RG 18 NA, as found in Cameron, p. 351.
[32] Smith, "Development of AAF and USAF Training," Dec 15, 1942, box 380, AAG, RG 18, NA, p. 100, as found in Cameron, p. 400.
[33] Cameron, p. 329.
[34] ATC Histories, January 1939-August 1945, K220.01 Vol. 3, p. 603, AFHRA

Training Command stressed the importance of high-quality instructors even at the cost of not sending all the best graduates to combat units. While still in the basic stage, students were evaluated as potential instructors—"flying ability, discipline, personality, and maturity were desirable qualities."[35] "Central Instructor Schools" were established (a training system within a training system) to train new instructors in improved methods and ensure uniformity and standardization. In an effort to rotate pilots between combat and training duties, combat returnees would replace instructors departing for overseas assignments. This was also designed to inject combat-experienced pilots into the training system. Many of the returnees, however, who by 1945 made up the majority of the instructor cohort, found it difficult to return to the relatively low-performance aircraft used in the Training Command.[36]

Training Command gets little recognition in World War II aviation histories. The subject of training simply lacks the appeal of combat heroics. Nevertheless, Army aviation leaders recognized its importance and rapidly expanded an existing pilot training system to produce nearly 200,000 pilots during the war.[37] Almost equally astounding was the postwar demobilization—by 1947, annual production had plummeted to just 369 pilots.[38] The phased, specialized pilot training system, the broad outlines of which were established before World War I and reinforced during World War II, remained in place well into the Cold War era.

[35] Ibid.
[36] Ibid., p. 788.
[37] AETC History Office, "Pilot Production Numbers."
[38] Ibid.

Figure 2: AT-6 Texan

Source: Photo courtesy of USAF Museum

There were, however, several post-war modifications; and the availability of training aircraft played a large role in determining UPT's structure. In 1947, the primary and basic stages were combined into "integrated basic" using the abundant AT-6 trainer (See Figure 2 above) for the entire phase. Students were then tracked, based on performance, desires, and Air Force needs, into either a single-engine or twin-engine advanced stage.[39] The total course length also returned to approximately one year. The first jet aircraft for training purposes arrived in 1949; and throughout the decade of the 1950s, the T-33 jet trainer was used for advanced single-engine training. The twin-engine track used the modified World War II-era B-25 (re-designated the TB-25, see Figure 3 below) during this period. After its post-war contraction, the system experienced another expansion in the early 1950s to meet the increased production demands of the Korean War. In 1953, the Air Force produced 5,265 pilots—a post-World War II high.[40]

[39] HQ ATC, "Major Changes in Undergraduate Pilot Training, 1939-1965", K220.03-28, AFHRA.
[40] AETC History Office, "Pilot Production Numbers."

Figure 3: TB-25 Trainer

Source: Photo courtesy of USAF Museum

The end of the 1950s marked a significant turning point in undergraduate pilot training. As early as 1957, with "project all-jet," consideration was given to adopting an all-jet, generalized pilot training program. The Air Force acquired the T-37 in 1958 as its primary trainer, while the advanced phase continued to use the much older T-33 jet trainer (see Figure 4 below). Contributing to the generalized training idea was the failure to find or fund a replacement for the aging TB-25 twin-engine trainer. Also, the Air Force was acquiring jet bombers, tankers, and transports, which added further support for a slick, "all-jet" system. The TB-25 was officially phased out in 1959, leaving, somewhat by default (because no suitable replacement was available), a generalized, all-jet program using the T-37 and T-33.[41] The newly acquired, supersonic T-38 began replacing the T-33 as the advanced trainer in 1961. With two newly acquired training jets (the T-37 and T-38) and most budget dollars flowing to the strategic force, there was little impetus to acquire a new multi-engine trainer. These factors firmly established the true all-jet, generalized undergraduate pilot training program that remained in place for over three decades, becoming for many of its graduates a cultural rite of passage. This approach to pilot training, however, represented a departure from the historically-proven specialized approach.

[41] HQ ATC, "Major Changes in Undergraduate Pilot Training, 1939-1965."

Figure 4: T-33 Trainer

Source: Photo courtesy of USAF Museum

An analysis of the history described in this chapter reveals several key variables that determined the use of either a specialized or generalized system. Most of these variables emerged as early as World War I. That war witnessed the rapid differentiation of operational roles and missions for aircraft. The aircraft themselves, of course, were also being designed for specific functions. These "specialized" missions and aircraft were sufficiently different to require pilots with unique sets of skills and training. A second determining factor was production requirements. Wartime exigencies dictated an industrial-type approach to produce the required numbers of pursuit, attack, observation, and bomber pilots most efficiently. Pilots had to be deployable shortly after graduation—any extra training was a seemingly unaffordable luxury. Therefore, training was tailored to meet the specific needs at the front. Again, this drove a tracked, or specialized approach. When massive production increases were not present or projected, as was the case in the nuclear-bomber era of the 1950s, a generalized system became more feasible.

A third variable was the availability of suitable training aircraft. The rapid evolution of and funding priority for operational aircraft often left the pilot training system with insufficient or outdated trainers. A specialized system, in order to function as designed, would require aircraft that possessed at least comparable performance and handling characteristics as the operational aircraft. When these specialized trainers were not available or could not be acquired, the system, by default, became more generalized. As mentioned above, the newly acquired T-37 and T-38 arrived just as the TB-25 faded

away. With no wartime urgency dictating the acquisition of a new heavy trainer, the Air Force stayed with a generalized, all-jet program.

Contributing to this default system's acceptance, of course, was the fact that the common aircraft all students would fly were tailored to fighter-type flying. Had it actually been a fighter-type trainer that was missing, requiring all students to fly a transport-type trainer, the system would, most likely, not have been implemented. Air leaders assumed that training tailored to flying fighters was more demanding and would provide at least some transferability to any future aircraft. The reverse seemed unlikely. It was also suggested at the time that the new system produced a more flexible force structure (a point explored in the next chapter). It is important to note, however, that the arrival of generalized UPT resulted more from hardware realities and cultural trends than any fundamental shift in training philosophy. Actually, the Air Force instituted an official training philosophy, Instructional Systems Development (ISD), just as generalized UPT began. However, generalized UPT clashed with several ISD principles.

Chapter 3

Instructional Systems Development (ISD) and the Coming of SUPT

Instructional Systems Development (ISD) is the closest thing the US Air Force has to an official training doctrine. In fact, Air Force Policy Directive 36-22 mandates the use of ISD principles in the development of all Air Force training programs.[42] This chapter defines and explains ISD methodology; traces its influence on the Air Force decision to transition from a generalized (UPT) to a specialized (SUPT) approach to training; and, finally, assesses the two approaches based on their adherence to ISD principles, cost, effect on force structure flexibility, and responsiveness to operational needs.

AFMAN 36-2234 defines ISD as a "deliberate and orderly, but flexible process for planning, developing, implementing, and managing instructional systems." Additionally, "it ensures that personnel are taught in a cost-effective way the knowledge, skills, and attitudes essential for successful job performance."[43] The goal of the process is to increase both the efficiency and effectiveness of training programs by "fitting instruction to jobs, and eliminating irrelevant knowledge from courses." With obvious applicability to the training of pilots, ISD also emphasizes the development of training "media" that offer "the greatest learning transfer capability."[44] As the language indicates, the idea has its roots in the systems approach to industrial management that emerged in the 1950s. Not surprisingly, ISD is also frequently referred to as the Systems Approach to Training (SAT).[45]

The actual process, depicted graphically in Figure 5, consists of the following five interrelated steps:

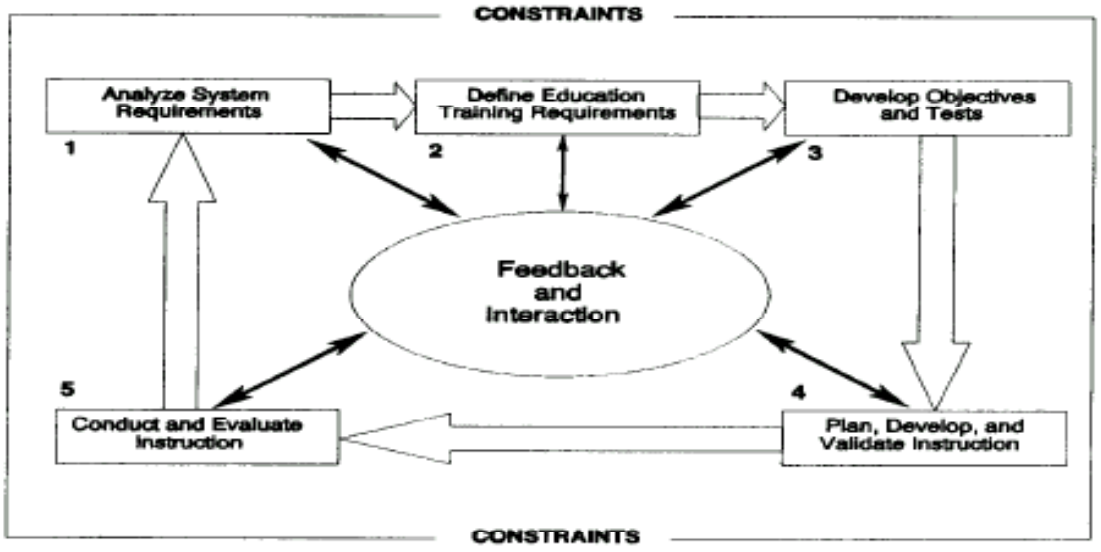
---

[42] AFPD 36-22, 17 September 1993, p. 1.
[43] AFMAN 36-2234, 1 November 1993, p. 5.
[44] AFM 50-2, 15 October 1977, p. 8-5.
[45] Air Training Command Historical Monograph, *Concepts and Programs for Future Undergraduate Pilot Training Programs,* 1 September 1975, p. 6, K220.04-37, AFHRA.

(1) *Analyze System Requirements.* This is accomplished through a thorough analysis of the human behaviors required to perform a given job successfully. These requirements are derived from the needs of the end-users, or customers. In the context of pilot training, the customers are the gaining operational commands. The product of this step is a comprehensive list of required tasks.

(2) *Define Education and Training Requirements.* This step determines who will be trained, and what training is needed, if any, to perform the tasks identified in Step 1. Step 2 also addresses constraints
such as time, equipment, infrastructure, cost, and availability of funding.

Figure 5: ISD Model
Source: AFMAN 36-2234, 1 November 1993, p. 9



(3) *Develop Objectives and Tests.* These objectives clearly identify both what the trainee is supposed to do and the required standard of performance. Students are tested against specific criterion-based objectives as opposed to a normative reference, in which a trainee's performance is compared to that of other trainees.

(4) *Plan, Develop, and Validate Instruction.* This step determines the optimum sequence of instruction, and the best media and methods to support the learning objectives. The validation process is usually carried out with a small trial group of

trainees to determine if the training program enables them to achieve the desired objectives.

(5) *Conduct and Evaluate Instruction.* This final step provides the necessary feedback in order to assess, maintain, and enhance the effectiveness and efficiency of a training program. It also makes the training system responsive to changes in end-user needs.[46]

The Air Force was actually one of the first organizations to put the ISD concept into practice. At the height of the Cold War in the 1950s, the Air Force used ISD techniques to train operators for its rapidly evolving space-launch and ballistic missile systems.[47] Interestingly, coincident with the emergence of ISD as its training doctrine, the Air Force instituted generalized, all-jet pilot training in the early 1960s. This approach to training, which remained in place for over three decades with attendant cultural legacies, existed largely in tension with ISD principles.

This tension was due to the fact that all students, regardless of future assignment, were trained in the same aircraft (the T-37 and T-38, see Figures 6 and 7) under the same syllabus. This approach did not align with the ISD precepts of "fitting instruction to jobs and eliminating irrelevant knowledge," using training "media" with the "greatest learning transferability," and minimizing expense.[48] Acrobatics and four-ship close-formation flying in the T-38, for example, did not provide optimal training transferability for students destined for airlift or tanker assignments. Additionally, operating costs for the high-performance T-38 far exceeded those required for a trainer with better transferability to "transport"-type flying. While such a transport-type trainer was not readily available during UPT's early years, emerging business jets offered a potential "off-the-shelf" solution. These incongruities, as well as emerging T-37/T-38 life-cycle concerns, led to a multitude of official studies and research projects that explored alternatives to generalized UPT.

Another factor in this search for UPT improvements was the fact that ISD concepts were congruent with the Total Quality Management (TQM) principles being pursued by Air Force leadership in the early 1990s. Air Force training publications

[46] AFM 50-2, p. 1-3.
[47] Ibid., 31 December 1970, p. 1-2.
[48] Ibid., 15 October 1977, p. 8-5.

reflected this. In the 1993 AFMAN 36-2234, a section titled "ISD is QI" states that, "ISD is a quality improvement (QI) process," with "processes and products... continuously assessed for quality with emphasis on how well they meet users' needs."[49]

Figure 6: T-37B "Tweet" Trainer

Source: Photo courtesy of USAF Museum

With these institutional trends and a wealth of analytical research data suggesting room for improvement, it is not surprising that the pilot training studies conducted in the 1970s and 80s were nearly unanimous in their advocacy of a more specialized approach.

An overriding reason for this emerging consensus was the potential for SUPT to deliver both large cost savings and better training. In response to a 1988 Congressional mandate to develop a plan that addressed the most cost-effective means for meeting pilot training requirements, the Air Force produced a Trainer Masterplan. This plan concluded that "among the possible alternatives to the present system of UPT, Specialized Undergraduate Pilot Training (SUPT) provides the highest quality graduate for the lowest expenditures in procurement, operations, and support."[50] Several earlier studies from the 1970s reached similar conclusions. For example, the 1975 "Concept Feasibility Study on UPT Dual Tracking" conducted by Air University found that "dual-track programs appear more in keeping with the key underlying principle of cost effective training...that

[49] AFMAN 36-2234, 1 November 1993, p. 9.
[50] *USAF Trainer Masterplan*, March 1988, pp. i-iii, K168.03-2152, AFHRA.

is, only the training necessary to perform the desired task...is provided."[51]

Most of these proposed dual-track systems involved acquiring a new "heavy" trainer aircraft, or Tanker-Transport Training System (TTTS). T-38 life-cycle concerns grew in the early 1970s as pilot production (which has historically fluctuated) increased to nearly 4000 per year.[52] TTTS would relieve "more than half of the training load on the T-38," and allow ATC to postpone its replacement. Also, the reduced fuel, operating, and maintenance expenditures associated with TTTS (this aircraft would ultimately be the T-1A Jayhawk, see Figure 8) under the SUPT concept would rapidly offset initial procurement costs.[53] In fact, HQ ATC found in its 1975 study, "Comparison of UPT Generalized vs. Specialized," that "cumulative variable cost savings would amortize the acquisition costs of 176 aircraft over a pay-back period of 5.1 years."[54]

Figure 7: T-38A "Talon" Trainer

Source: Photo courtesy of USAF Museum

Beyond these estimated savings, the Air Force had already realized actual savings when Tactical Air Command, in response to a 1970 Chief of Staff directive, applied ISD concepts to its C-130 and A-7D transition training programs. The C-130 program produced an estimated savings of $11,265,000 in only 16 months, while an estimated

[51] *Concept Feasibility Study on UPT Dual Tracking*, 18 April 1975, Atch. 2, p. 1, K239.15-8, AFHRA.
[52] AETC History Office, Pilot Production Statistics, www.aetc.af.mil
[53] *USAF Trainer Masterplan,* p. 25
[54] *Comparison of UPT Generalized vs. Specialized,* HQ ATC, December 1975, p.28, K220.01 vol. 7, AFHRA.

$43,000 per student was saved in the A-7D program.[55] The dollars, while not the only consideration, clearly added up in favor of implementing SUPT. A recent AETC cost comparison of generalized UPT (FY 1993) vs. SUPT (FY 2000), using inflation-adjusted dollars, confirmed that the predicted savings did, in fact, materialize. While the T-38 cost per student expectedly changed little, the T-1A track (making up about 65% of the students) realized an approximate savings of $200,000 per student.[56]

In addition to fiscal considerations, several of the early studies also questioned the notion that generalized UPT provided force structure flexibility by producing a "universally assignable" pilot.[57] The Air Force has, for obvious reasons of efficiency, always "tracked" pilots into either "heavies" or "fighters." Building technical expertise and full combat capability takes several years, regardless of platform. Changing tracks is rare. The fact that technical competence and credibility in a specific weapons system remains a prerequisite for pilot career progression also contributes to "stove-piped" career tracks. The results of a 1974 Inspector General (IG) Investigation of Undergraduate Pilot Training flatly disagreed with the idea that generalized UPT produced a more flexible force structure.

Figure 8: T-1A "Jayhawk" Trainer

Source: Photo courtesy of USAF Museum

This report's first finding stated that "the universally assignable UPT graduate policy was invalid and not cost effective." It also stated that "graduates were not all qualified to fly fighter aircraft with minimal transition as specified in the USAF Formal

[55] Air Force Pamphlet 50-58, *Handbook for Designers of Instructional Systems,* June 1973, p. 4-12.
[56] Data provided by AETC/FMAF, 13 February 2002, e-mail reply to research request.
[57] ATC Historical Monograph, *Concepts and Programs for Future UPT,* p. 1, K220.04-37, AFHRA.

Schools Catalog, AFM 50-5."[58] A 1977 ATC staff study group corroborated the IG's findings. Through a survey of records at the Military Personnel Center (MPC), the group found that during the peak six years of the Vietnam conflict (1966-1972), a worst-case scenario for force-structure management, fewer than 10% of pilots cross-trained between weapons systems.[59] Furthermore, these pilots all received the same conversion training regardless of whether they had graduated from specialized (pre-1960) or generalized undergraduate pilot training.

This remains true today. The current T-38 conversion course is designed for "pilots assigned to a fighter type aircraft currently qualified in a non-fighter aircraft or who flew the T-1A in SUPT."[60] In short, very few pilots cross-train; and those who do require the same conversion course regardless of which undergraduate pilot training program they attended. In spite of these findings, AETC's recent proposal to return to a more generalized training program cited "flexibility in rated management" as a guiding rationale.[61] This seems to fly in the face of the evidence. AETC/HO (historical office) confirmed the rarity of pilots changing "tracks" after entering a specific operational pipeline. The only formal program they could find was a limited "crossflow" training program in which a total of approximately 150 "heavy" pilots transitioned to fighters between FY 1997-2000 to fill a critical shortage of fighter pilots in specific year groups.[62] All of these "crossflow" pilots went through a conversion course in the T-38 followed by IFF (Introduction to Fighter Fundamentals) in the AT-38 before starting training in their specific fighter aircraft.

Even under generalized UPT, students received assignments and were placed in "mini-tracks" a few weeks prior to graduation. These tracks tailored their few remaining sorties in the T-38 based on future assignment—this branch point represented the root starting point into their specialized flying careers. Pilots were "tracked" based on service needs, flying capabilities, and personal desires, in that order. Those with Fighter/Attack/Recon-naissance (FAR) assignments flew six additional formation sorties,

[58] Interim Memorandum Report of the Inspection of UPT Quality Assurance, 18 November 1974, p. 1, K220.01, AFHRA.
[59] Synopsis of SUPT attached to 13 Feb 1980 letter from CSAF to TAC/CC, p. 2, 168.7339-214, AFHRA.
[60] AETC Syllabus F-V5A-R, January 2000, p. 1.
[61] 23 October 2001 Corona Conference Briefing Slides.
[62] 11 February 2002 AETC/HO e-mail response to research inquiry.

while students destined for Tanker/Transport/Bomber (TTB) assignments instead received six additional instrument/navigation sorties.[63] Tracking pilots is how the Air Force manages its rated force. In light of this fact, the issue becomes not whether to track, but determining the optimal point along the training continuum to do so.

Determining that optimal point was another area that received a great deal of attention in the research. Actually, as late as 1989, the ATC commander, Lt. Gen. Robert Oaks envisioned a totally specialized system with students being tracked "before they enter primary training."[64] Air Force Chief of Staff, Gen. Larry D. Welch, had directed this approach at a 1987 Corona Conference.[65] While the approach seemed congruent with ISD efficiency principles (by eliminating any extraneous training), it raised the obvious problem of identifying the appropriate track before a student entered formal training. Generalized UPT, through a Darwinian process of natural selection, produced a very accurate picture of a student's capabilities (at least to fly fighters) and class standing, while also allowing students enough time to make an informed decision regarding their desired aircraft. Achieving a comparable degree of fidelity in this area under SUPT (as then envisioned) would be difficult.

In order to address this problem, HQ ATC/XP proposed using a Pilot Selection and Classification System (PSACS). This system, never ultimately implemented, was designed to "select only the best qualified and most career motivated applicants for pilot training; and classify all applicants for optimal success into one of four aircraft categories (bomber, fighter, tanker, or transport)."[66] PSACS would select and classify students using a "computerized Portable Basic Attributes Test (Porta-BAT)." The Air Force Systems Command's Human Resources Laboratory had been researching these kinds of tests for years. The tests weighed a variety of factors—"psychomotor ability, cognitive skills, motivations, personality traits"—that were supposedly "predictive of UPT success...or indicated a candidate's suitability for an aircraft category."[67]

In spite of the effort expended on PSACS, decisions made at the 1991 Corona Conference diminished the necessity for pre-SUPT track classification.

---

[63] ATC Syllabus P-V4A-B, October 1987, pp. 55-58.
[64] Robert Oaks, *TIG Brief,* Vol. 5, September-October 1989, p. 23.
[65] ATC History, Vol. 1, 1991, p. 226, K220.01, AFHRA.
[66] *History of Human Systems Division,* October 1987-September 1988, Vol. 5, p. 1, K237.01, AFHRA.
[67] Ibid.

At that conference, then Chief of Staff, General Merrill A. McPeak, directed that students be tracked after the T-37 primary phase rather than before training started. He indicated that track classification would depend on service needs, merit, and student preference.[68] Making the track decision at the end of T-37 training was not a new idea. This, of course, approximated the approach used for the first 50 years of pilot training. Also, several independent studies, and ATC itself (years earlier), recommended the end of primary phase as the optimal decision point. It was also logical to retain some of UPT's strengths, such as accurately identifying pilot capability before determining track, while also requiring a less radical change to a proven program. A formation flying check-ride was also later added to the T-37 syllabus (making four instead of three total check-rides in the phase) in an effort to improve student stratification prior to the track point.[69] The Air Force did, in fact, implement SUPT in 1992 with track determination occurring after the T-37 phase. Tests such as PSACS, while perhaps statistically accurate determinants of UPT success, in and of themselves, provide insufficient data upon which to base a track decision. To achieve that aim, the tests would have to be coupled with at least some type of actual flying.

The USAF eventually adopted a modified version of PSACS to pre-select SUPT candidates: the Pilot Candidate Selection Method (PCSM). PCSM "quantifies a pilot candidate's aptitude for success at Undergraduate Flight Training."[70] The goal is not to make a track determination, but to "provide the UFT selection boards with data to make the most informed decisions on UFT candidates."[71] SUPT selection boards operate on the "whole person" concept, but the PCSM score is a significant factor in the decision.

The PCSM score is based on three weighted areas: previous flying hours (more is better), pilot-related sections of the Air Force Officer Qualification Test (AFOQT), and Basic Attributes Test (BAT) performance. The BAT (which can only be taken once) is the most heavily weighted factor in the PCSM score and uses a computerized video screen and joysticks to test areas such as cognitive function, psychomotor response,

[68] ATC History, Vol. 1, 1991, p. 227, K220.01, AFHRA.
[69] Major Bob Volte, T-37 ADO, Vance AFB, OK, 24 Apr 02, telephone interview by author.
[70] AETC Studies and Analysis Squadron (SAS), PCSM Information Page, "The PCSM Program Explained," www.aetc.randolph.af.mil/sas/pcsm/.
[71] Ibid.

attitudes toward risk-taking, and hand-eye coordination.[72] The PCSM assigns a score from 1-99. According to AETC's Studies and Analysis Squadron, candidates who score above 75 have a 96% probability of completing SUPT, while only 64% of those with scores below 25 complete SUPT.[73] The SUPT program itself has now been in place sufficiently long to draw comparisons with UPT and assess its performance in meeting Air Force operational needs.

To make that assessment, one needs to be clear on the ultimate purpose of Air Force pilot training. That purpose is to produce, through selection, training, and education, young officers with the necessary qualifications and characteristics to fly Air Force major weapons systems—not to produce students proficient in trainer aircraft. It logically follows that, in keeping with ISD principles, the gaining commands (the "customers") should have a large role in shaping syllabus requirements and establishing course-training standards. This was, and is, in fact, the case. ATC routinely conducted field visits and conferences to gather information on the quality of its UPT product—AETC has continued the practice under SUPT. A comparison of this survey data illuminates several limitations of the generalized approach.

Headquarters ATC/DOXT, after conducting one such survey, published a 1974 UPT Field Evaluation Report. Its general findings mirrored those of a study conducted by Northrop Corporation in 1970. Formation flying was a recurrent area of concern from TAC with inputs such as "give more formation flights" being typical.[74] Strategic Air Command (SAC) and Military Airlift Command (MAC), on the other hand, had concerns with low-altitude instrument procedures and crew coordination. A 1980 study conducted by the Air Force Human Resources Laboratory similarly found, after extensive field surveys of MAC and SAC pilots, that crew coordination and instrument procedures were cited repeatedly as weak areas.[75] Attempts to satisfy both the "heavy" and "fighter" customers highlighted a limitation of the generalized approach. Namely, with a finite number of training sorties available, any syllabus change designed to satisfy one group

[72] AETC Histories, 1 January 1996 – 31 December 1999, Vol XXV, "Pilot Candidate Selection Method" Briefing, AETC/SAS, K220.01, AFHRA.
[73] Ibid.
[74] *Future Undergraduate Pilot Training System Study,* prepared by Northrop Corp. for Air Force Systems Command, March 1971, Appendix IX, p. 97.
[75] *SUPT: Tanker/ Transport / Bomber (TTB) Training Requirements,* AF Human Resources Laboratory, Final Report, August 1980, Appendix B, pp. 117-152.

would likely dissatisfy the other. Opportunity costs were high. Also, some of the identified weak areas simply could not be adequately addressed in the T-38 "medium." Finally, most changes requested by the fighter community, if implemented, would directly benefit fewer than a third of the students—the proportion historically assigned to fighters.

This historically low proportion of pilots going to fighter assignments called into question the wisdom of tailoring an entire training program around fighter-type flying. The T-38 had excellent transferability to fighters, but training future MAC and SAC pilots in the aircraft did not align with the ISD concept of "matching media to task." This is not to suggest, however, that generalized UPT was a "broken" system, only that a generalized program was inherently less capable of meeting competing needs from various operational communities. Obviously, T-38 training benefited a pilot to some degree regardless of future aircraft—the question was whether the benefit could be enhanced. Crew coordination, cell formation, and handling asymmetric thrust problems were just a few customer-identified problem areas that could not be covered well in a T-38 syllabus. MAC and SAC were also often underrepresented among T-38 instructors. This led several MAC and SAC supervisors to complain that "UPT paints a dismal picture of life as a multi-engine pilot."[76] This area too would be improved with a specialized approach. Tracked students would benefit from having instructors with operational experience in the same or similar airframe and flying community.

While SUPT survey data is not yet definitive, at the Fall 2001 Corona Conference, AETC briefed that "customers like product—follow-on training units report 100% satisfaction rate on last 12 classes."[77] Current T-1A instructor pilots, in recent telephonic interviews, supported this statement (at least with respect to the "heavy" community), stating that "feedback from follow-on training programs has been positive."[78] Feedback from the fighter community, however, is mixed. AETC conferences with representatives from fighter follow-on training units indicate concerns not unlike those voiced for years under the previous UPT program. This is not particularly surprising because the T-38 portions of the old UPT and current SUPT

[76] UPT Field Evaluation Report, prepared by HQ ATC/DOXT, Randolph AFB, TX, April 1974, p. III-13.
[77] 23 October 2001 AETC Corona Conference briefing slides.
[78] Data collected from telephone interviews of instructor pilots at Vance AFB, OK, 13 February 2002.

syllabi are virtually identical.

There is, however, increasing concern with the overall quality of pilots entering the fighter pipeline. Complaints from Introduction to Fighter Fundamentals (IFF) and fighter training unit instructors have increased in recent years. Notwithstanding the fighter community's habitual tendency to rate the incoming raw material as weak, several factors (some more quantifiable than others) lend some legitimacy to their concerns. There is a near total absence of fighter presence in T-37 squadrons. Frequently, top-ranked students from the T-37 phase opt for the T-1A track.[79] This, in and of itself, of course, is not cause for concern. But the SUPT T-38 attrition rate in FY 2000 was 0.0%.[80] Under generalized UPT, average T-38 students who met graduation requirements, simply did not get "FAR" qualified. Under the current SUPT construct, no such option exists. Foreseeing this potentiality when deciding to adopt SUPT, Air Force leaders were willing to accept up to a 10% attrition rate in the T-38 to ensure quality control.[81] T-38 instructors may be having difficulty eliminating students from training who would, under generalized UPT, simply not have been "FAR" qualified.

As mentioned above, follow-on training units in the "heavy" community are generally very satisfied. A comparison of the SUPT T-1A syllabus with the former UPT T-38 syllabus brings to light some of the benefits brought forth through specialized training and at least partially explains the positive feedback from the "heavy" community. Under the June 2001 SUPT T-1A Syllabus, Tanker/Transport students receive training in the following areas that were not covered at all under the October 1987 UPT T-38 Syllabus[82]:

Radar Operation (for weather observation / avoidance)
Use of Autopilot
Copilot Duties
Use of computerized Flight Management System (FMS)
"Glass Cockpit" Avionics Use
Crew Coordination to include:

---

[79] Ibid.
[80] *"Flying Training Attrition,"* 2001 AETC Briefing, Allocations and Assessments Branch, Randolph AFB, Texas.
[81] James R. Robinson, Chief, AETC Allocations and Assessments Branch, Randolph AFB, Texas, 6 May 2002 telephone interview by author.
[82] Comparison of October 1987 T-38 Syllabus (P-V4A-B), June 2001 T-1A Syllabus (P-V4A-G/F-V5A-Q).

Providing positive leadership to the crew
Crew participation in decision-making process
Clearly communicating decisions to crewmembers
Delegating appropriate tasks to other crewmembers
Recognize / eliminate hazardous attitudes in self and other crewmembers
Cell Formation
Asymmetric thrust emergency procedures
Airdrop simulation
Air Refueling procedures

Clearly, from an ISD task analysis perspective, SUPT proves more capable than UPT in meeting the often competing "customer" demands from various operational communities.

Of course, Air Force pilot training cannot be viewed as a purely technical training program. Teaching a soldier how to assemble and fire a rifle in a given amount of time is technical training. Undergraduate pilot training is also education. The program seeks to imbue graduates with less quantifiable traits—leadership, esprit de corps, confidence, courage, decisiveness, judgement, etc.—that ideally characterize military pilots. This human, less-quantifiable aspect of the program, of course, is not reducible to a set of measurable tasks and does not fit as neatly into the ISD framework. The role of the instructor pilot is critical in this human component of pilot training. This subject will be addressed in more detail in the next chapter.

Nevertheless, the preceding assessment of UPT versus SUPT within the more quantifiable ISD framework yields some clear findings. Unarguably, SUPT is more aligned with ISD principles. The specialized method of training better matches media to task, is more responsive to end-user needs, and has produced large cost savings for the Air Force. Also, the evidence demonstrates that SUPT has had little, if any, adverse effect on force structure flexibility.

In addition to SUPT's implementation, the Air Force has, in recent years, introduced other structural changes to its pilot training system. Specifically, both its screening program and instructor force have undergone significant alterations. Chapter Four describes the genesis and implications of these two changes.

Chapter 4

Structural Changes to SUPT: Genesis and Implications

Over the last decade, beyond its SUPT transition, the Air Force has made two additional structural changes to its pilot training system. Unlike SUPT, however, these changes were implemented in response to very pressing external conditions and events. For example, with the 1997 grounding of the entire T-3A Enhanced Flight Screener fleet, the Air Force's flight screening program was in disarray. The replacement program, Introductory Flight Training (IFT), requires that candidates earn a private pilot license from a civilian aero club prior to SUPT. Pilot retention and manning shortfalls catalyzed the second significant alteration. Air Force Reservists now comprise a large percentage of the SUPT instructor force. This chapter describes the genesis of these changes and evaluates their implications and effects.

Flight screening in the Air Force began in the early 1950s. From that time forward, some form of light-plane screening has been a part of training Air Force pilots. The program was designed to reduce pilot training attrition and avoid having to eliminate candidates after a large training investment had already been made. With a mid-1960s, 42-hour reduction in T-37 flying hours, the screening program took on added importance, and an expanded syllabus was introduced.[83] To support this growth, in 1965, the Air Force selected and acquired the T-41 (a modified Cessna 172) as its main flight-screening aircraft (see Figure 9 below).

All three of the Air Force's commissioning sources eventually used the T-41 for screening, though under different programs. The Air Force Academy, in 1968, implemented a T-41 Pilot Indoctrination Program (PIP) to motivate cadets "toward a rated career, to identify…cadets who lack the basic aptitude to be an Air Force pilot, and to minimize attrition…in Air Force pilot training."[84] Air Force ROTC cadets had been

[83] AETC Histories, 1 Jan 96-31 Dec 99, Vol XXVI, "History of the Enhanced Flight Screening Program," p. 6, K01143244-3273, AFHRA.

[84] Ibid.

flying a 40-hour Flight Instruction Program (FIP) since the mid 1950s. The ROTC FIP program, which was conducted at over 40 civilian training sites around the country, had contributed to a reduction in primary phase pilot training attrition from 25 to 6 percent over several years.[85] A 1972 effort to balance the flight experience of incoming UPT students and reduce the high attrition rates of Officer Training School (OTS) graduates (who until then had no screening program and, at that time, accounted for 81% of phase I UPT eliminations) led to a T-41 screening program for OTS pilot candidates at Hondo Municipal Airport, Texas.[86] By 1988, the Air Force had consolidated all ROTC and OTS screening into a single, 14-hour T-41 program at Hondo using military instructors.[87] Air Force Academy cadets participated in a similar T-41 program at Colorado Springs.

Changes were in store for the program, however, with the Air Force's late 1980s decision to implement SUPT. In 1987, the Air Force Chief of Staff, General Welch, directed the acquisition of an enhanced trainer that would enable a "track" selection to be made prior to the primary phase of SUPT.[88] The goal was to obtain a fully aerobatic

Figure 9: T-41A "Mescalero" Trainer

Source: Photo courtesy of USAF Museum

[85] Ibid.
[86] Ibid., p. 7.
[87] Federation of American Scientists, Military Analysis Network, T-41A program info, www.fas.org.
[88] AETC Histories, 1 Jan 96-31 Dec 99, "History of the Enhanced Flight Screening Program," p. 2, K01143244-3273, AFHRA.

airframe capable of flying overhead patterns (the T-41 was not designed for these maneuvers) using mainly military instructors.[89] This would add rigor to the screening program, give prospective UPT students early exposure to high-performance, military-type flying, and better determine flying aptitude and potential. The T-41 programs at Hondo and the Air Force Academy would change to the new aircraft and fly under a common syllabus. This idea eventually came to fruition when the Air Force acquired 113 T-3A Enhanced Flight Screeners (EFS, see Figure 10 below). The Air Force began training a cadre of military and civilian instructors in early 1994. The first class of students began flying the

Figure 10: T-3A "Firefly" Trainer

Source: FAS Military Analysis Network, www.fas.org

"Firefly" in July of 1994.[90] Under the Enhanced Flight Screening Program (EFSP) syllabus, students received approximately 25 hours of instruction in the aircraft, to include a solo sortie and check ride, over the 19-sortie course.[91] The T-3A program involved screening, of course, but also training to an extent beyond previous programs. EFSP was mandatory for all prospective SUPT students, with or without a private pilot license.

After a series of mishaps, however, the Air Force grounded the T-3A, effectively

[89] ATC History, 1991, Vol. I, "Implementing SUPT," p. 224, K220.01, AFHRA.
[90] AETC Histories, 1 Jan 96-31 Dec 99, "History of the Enhanced Flight Screening Program," p.11, K01143244-3273, AFHRA.
[91] Ibid.

ending the EFSP concept after only three years. After two years of studies and investigations, the T-3A program was officially cancelled in October of 1999. The Air Force went without a screening program for over one year while these investigations were being conducted. In November 1998, however, seeking at least a temporary "fix" and hoping to quell rising T-37 attrition rates, the Air Force "stood up" EFSP's de-facto successor program, Introductory Flight Training (IFT).[92]

IFT represents a return to the civilian aero club approach. Over 150 FAA-certified flying schools nationwide provide flight instruction to ROTC and OTS candidates. Air Force Academy cadets fly the same program at the Academy aero club during their senior year. IFT, as its name suggests, does not actually "screen" or eliminate many candidates—thus far, between 2-3% of candidates have not completed the program for various reasons.[93] The program has two officially stated purposes: to prepare prospective pilots for the rigors of SUPT, thereby reducing attrition, and to give candidates an opportunity to determine if an Air Force flying career is right for them.[94] The Air Force Academy IFT program's chief pilot stated that in the program's first two years at the Academy, three cadets were eliminated for flying deficiency, and "about three or four self-eliminated."[95] The course originally required SUPT candidates (who did not already hold a private pilot license) to log 40 light plane flying hours and solo at least once in those 40 hours before entering SUPT. In January 2000, however, IFT expanded to a 50-hour program, with a requirement that candidates solo within 25 hours and earn their private pilot license within the allotted 50 hours.[96] This construct remains in effect to date.

Scientifically determining the effects and implications of the recent tumult in the Air Force's screening program is difficult. Pilot training attrition rates have historically fluctuated due to a multitude of external factors, many of them not easily quantified. For example, as production demands increase, attrition rates generally rise. With low

[92] HQ AFROTC/DO, "Introductory Flight Training, Information Package," 4 October 2001, p. 6U, www.afoats.af.mil/ift.
[93] James R. Robinson, Chief, AETC Allocations and Assessments Branch, results of telephone interviews by author, April 2002.
[94] HQ AFROTC/DO, "Introductory Flight Training, Information Package," p. 6U.

[95] Justin Hoover, USAFA IFT Program Chief Pilot, telephone interview by author, 24 April 2002.
[96] Ibid.

production, only the very best enter the training pipeline and attrition usually decreases. Senior officers' expressed concerns about graduate quality have also periodically induced a change. Therefore, caution is advisable in any attempt to establish specific, direct correlations between attrition rates and various pilot screening programs. Too, some short-lived programs, like EFSP or, as yet, IFT, have not existed long enough to yield conclusive data. Nevertheless, sufficient evidence does exist to state with certainty that screening programs, in general, have a favorable effect on pilot training attrition. AETC's Allocations and Assessments Branch Chief, for years the command's foremost expert on attrition, confirmed this assessment.[97]

Having established this, a review of some statistics is in order. In a Secretary of the Air Force directed, "Broad Area Review of the EFSP," an analysis of all SUPT classes from 95-01 to 97-06 revealed that students from the T-41 screening program had a 13.4% attrition rate in the T-37, while those from the T-3A EFSP suffered only a 5.9% rate.[98] In a separate study done in September 1999, T-37 attrition data from 22 classes was analyzed. The following T-37 attrition rates were compiled for graduates of various screening programs: EFSP - 7.8%, IFT - 8.8%, T-41 - 11.3%, and "no screening program" – 15.6%.[99] Another interesting report examined the EFSP attrition rates at both the Academy and Hondo (those eliminated from the screening program itself) for 1,161 students between 1994 and 1997. 665 of these students (group A) already had a private pilot license before screening, the other 496 students (group B) had little or no flying experience. Of the 62 total students eliminated for flying deficiency, 52 were from group B. Of the 36 students initiating self-elimination, 33 were from group B.[100] Finally, during pilot training classes 99-1 through 99-9, a period when many students received no pre-screening, a total of 93 of 589 active duty students were eliminated from SUPT (15.8%). The success rate for students with screening was four times that of students that had no screening program.[101] These numbers and a wealth of earlier data indicate the general efficacy of flight screening programs.

An additional factor to consider when comparing different types of screening

[97] Robinson, Chief, telephone interviews by author, April 2002.
[98] AETC Histories, 1 January 1996 to 31 December 1999, Vol. XXV, p. 105, K01143249, AFHRA.
[99] Ibid., "Decision Brief on pre-JSUPT Flight Training."
[100] Ibid., p. 44, Table 2.4, "EFS Student Completion Rates."
[101] Walter D. Miller, "The Pre-Pilots Fly Again" *Air Force Magazine*, Vol 82, No. 6, June 1999.

programs is cost. In an October 1999 "USAF News Release" announcing EFSP cancellation, the Air Force stated that EFSP had cost $26M annually, while the newly implemented IFT program costs approximately $10M per year to operate.[102] This figure for IFT equates to approximately $4,000 per student. Considering the large cost of training a single pilot at SUPT, it becomes quite easy to see how quickly screening programs can pay for themselves in reduced attrition. Another "cost" variable is whether or not to use military instructors for screening. The T-3A program at Hondo operated primarily with civilian instructors, employing only 11 active duty instructor pilots. The academy's T-3A program, however, authorized 58 assigned and 55 attached military instructors.[103] IFT, of course, is entirely under civilian contract.

Centralized programs employing military instructors, while more expensive than the aero club approach, have advantages in the areas of quality control and mentoring and more closely resemble the training atmosphere students will encounter in the primary phase of SUPT. Too, a pool of experienced T-41 or T-3A military screening instructors provided a small surge capacity since they could always be re-qualified quickly into their operational aircraft if necessary. Civilian screening would always be available as a fallback option.

Based on the attrition statistics and cost factors addressed above, what screening system will best serve Air Force needs at present and in the future? Unarguably, some form of flight screening is a wise and necessary investment for the Air Force, particularly with the need to keep SUPT production at full capacity for several more years. Tracking SUPT students after the T-37 phase, as opposed to before entering SUPT (as originally envisioned), lessens the need for a higher-cost, full performance aircraft and more robust screening syllabus. The data suggests that T-3A screening proved slightly more effective at lowering SUPT attrition than did the lower-cost T-41 or IFT programs. The gain appears marginal, however; and, without the requirement for a pre-SUPT track decision, does not warrant a costly renewal (involving a new acquisition and training plan) of the EFSP concept.

---

[102] AETC Histories, 1 January 1996 to 31 December 1999, Vol. XXV, p. IV-136, "USAF News Release," K01143249, AFHRA.
[103] Ibid, "Current Operations and Support Concept," p. IV-I.

Instead, the Air Force should keep the IFT program in its current form and avoid inducing yet more change into what is still a maturing training program (SUPT). IFT is a simple, inexpensive, yet effective system that met the Air Force need for an easily implemented EFSP substitute. Keeping the program will save money, maintain system stability, and, most importantly, hold SUPT primary phase attrition at or below its currently programmed level of 12%.[104] The Air Force should, however, invest a portion of the realized savings into developing improved candidate recruitment and pre-selection mechanisms—ensuring that those entering IFT have the necessary character and motivation to become not only Air Force pilots, but also the Air Force's future leaders. The Israeli model (described in Chapter Five) provides useful insights into ways this might be done. Finally, the Air Force's current pilot shortage (projected to persist for another decade) imposes manning needs elsewhere that outweigh the re-fielding of a cohort of military screening instructors, however desirable that might be. One such area requiring more immediate attention is the composition of the SUPT instructor force itself.

The Air Force, responding to the growing pilot shortage in the mid-1990s (which will peak at nearly 2,000 pilots in FY02, a 14.3% shortfall), recently changed this composition by implementing the Air Reserve Component (ARC) Associate Instructor program.[105] Born of necessity, this pragmatic initiative replaces 225 active duty SUPT instructor billets (representing about 20% of the total SUPT instructor cadre) with approximately 85 full-time and 420 part-time reservists, releasing active duty pilots for operational assignments.[106] As then AETC commander, General Lloyd Newton said in reference to the ARC concept, "Our pilot shortage means we can no longer conduct business the way we have in the past."[107]

In implementing the ARC program, the Air Force capitalized on a "window of opportunity" by capturing many separating active duty instructor pilots who otherwise would have been wasted resources.[108] An added attraction was the fact that

---

[104] AETC, FY 2001 "Flying Training Attrition" Briefing, Allocations and Assessments Branch.
[105] AETC Histories, 1 January 1996 to 31 December 1999, Vol. XXII, "Pilot Prioritization Update Brief," delivered at HQ/USAF, 3 Nov 1998, K01143244, AFHRA.
[106] Daniel Duffey, AETC Force Management Branch, "Background Paper on AETC ARC Associate IP Programs," 7 October 2000.
[107] AETC Histories, 1 January 1996 to 31 December 1999, Vol. XXIII, p. IV-62, 24 June 1999 Memo from AETC/CC concerning ARC IP Program, p. IV-62, K01143249, AFHRA.
[108] Ibid, AETC/DO Rated Distribution Briefing, "Growing the USAF Pilot Force," October 1997, p. 34.

approximately 60% of these individuals were already current and qualified AETC instructors at the same training bases, thereby eliminating any need for a move or requirement for Pilot Instructor Training (PIT).[109] Most of the newly hired pilots also had a wealth of operational experience in major weapons systems. Significantly, 40% of them were separating from the critically undermanned fighter community, so recruiting this group would "free up" more active duty fighter pilots from AETC assignments.[110] Appealing to many separating pilots, a part-time reserve position in AETC involved no chance of being deployed, and allowed airline-bound pilots to retain many of the benefits and rewards of their prior military service. Moreover, the ARC program's full-time reservists are eligible for the pilot bonus and full retirement benefits after 20 years, while simultaneously enjoying the stability of never being deployed or moved—commonly cited causes of the pilot retention problem. ARC appeared to be a win-win arrangement.

This program has been hailed as a success story, and those who so rapidly conceived and implemented it indeed deserve much credit. It has undoubtedly mitigated the ill effects of the pilot exodus and salvaged some very valuable expertise. Nevertheless, there is always a price; and the Air Force has been largely dismissive of the program's potentially less salutary implications. 81% of ARC instructors are part-time with somewhat irregular availability.[111] Instructor-student continuity, critically important for mentoring, role modeling, and quality training outcomes, becomes much more difficult to establish and manage under this construct. ARC part-time instructors fill active duty instructor billets at a ratio of three-to-one. Inevitably, the smaller remaining active duty contingent accomplishes most of the squadron's routine additional duties. As one squadron commander said, "it's an additional work load in areas of life support, operations management, and scheduling."[112] In other words, the system works, but adds turbulence to the process. Too, simply due to the time available, "part-timers" will generally not be as savvy in systems and procedures as their full time counterparts. Furthermore, commander calls, instructor meetings, syllabus and procedural changes, publications updates, etc. are all part of regular flying operations that require regular

[109] 340th Flying Training Group, AETC/AFRC Associate IP Program "Metrics Report," 30 March 2002.
[110] Ibid.
[111] Ibid.
[112] 560th FTS commander, as quoted in *Citizen Airman,* "Rapid Growth, Reserve Flying Training Group Beefs Up in a Hurry to Ease Pilot Shortage," April 1999.

attention.

Another subtle effect of the ARC program is that SUPT flying squadron commanders no longer administratively control a large percentage of their flight instructors. All reservists belong, for administrative and promotional purposes, to a separate squadron, under a separate command structure. This diminishes the flying squadron commander's role and creates a somewhat disjointed squadron atmosphere—the students' first exposure to a military flying operation. When coupled with the scarcity of operationally experienced, active-duty instructors, the result is a system less capable of imbuing its graduates with the warrior-leader ethos and desired traits of an Air Force pilot. The instructor pilot's central role in this area cannot be overstated.

The present instructor composition in a typical T-37 squadron illuminates the situation. The vast majority of line instructors are either First Assignment Instructor Pilots, "FAIPs" (40-50% of the total) or reservists (20% active duty equivalent).[113] Active-duty tanker/transport pilots comprise most of the remainder, providing a valuable presence and most of the squadron's functional leadership. On average, not more than two active-duty fighter pilots can be found in an entire T-37 squadron; and one is usually the commander.[114] As a result of these current manning policies and conditions, full-time, experienced instructors are much less available to motivate and evaluate students, and the students themselves are generally less informed regarding their track selection and future assignment possibilities.

The ARC program was conceived and implemented as a "stop-gap" measure to reduce the operational damage being wrought by the Air Force's pilot shortage, particularly within the fighter community. Its success in accomplishing this objective does not mean it should be embraced and established as a permanent fixture in SUPT. As described above, not all of the program's effects are positive. As its pilot manning posture improves (forecast to be "fixed" by 2012-2014), the Air Force should phase out the program and begin to improve the instructor composition of its SUPT squadrons.

This should be accomplished with several near and mid-term initiatives. In the near term, the program's high percentage of part-time flyers should be reduced and, to the

[113] HQ AETC, "AETC IP Force Requirements and MWS Distribution Report," updated 1 April 2002.
[114] Ibid.

extent possible, replaced with full-time reserve positions. A contingent of full-time, operationally experienced reservists could, in fact, be made a permanent part of the SUPT system, providing valuable continuity and effectively filling the role of "career trainers." Furthermore, as the pilot shortage wanes, the Air Force should build a more balanced instructor force in its T-37 squadrons. In addition to a mix of FAIPs and full-time reservists, active- duty instructors should be proportionally represented from the various operational communities. A fighter presence in the primary phase of SUPT should be established. The T-38 and T-1A tracks should continue to be populated almost exclusively with operationally experienced instructors in relevant weapon systems. Implementing these changes will require several years. But more importantly, it will require hard, strategic choices from Air Force leaders willing to make sacrifices in areas other than training.

Historically, when the Air Force has been faced with lean budgets or pilot shortages, it has looked first to its training programs to find savings and solace. Perhaps this is as it should be. If so, however, it must also be accompanied by a continual awareness that sustained cuts in this area have long-term consequences for the health of the force. Temporary solutions to pressing problems must not, through inertia, become the de-facto norm. People are the most critical resource to guarantee the Air Force's continued dominance in the 21st century—necessary investments in this area will continue to yield handsome returns.

Chapter 5

US Navy and IAF Pilot Training: Lessons for the USAF?

This chapter broadens the analytical scope by examining how the U.S. Navy and Israeli Air Force (IAF) train their pilots. These two institutions have long-standing, high quality training programs from which much can be learned. The Navy represents an interesting case study because its program developed separately, but in parallel with the USAF system under similar contextual influences. Significantly, in what constitutes a major shift for both the Air Force and Navy, joint pilot training has been introduced; and the two services have also begun joint procurement of a common primary trainer, the T-6A. The effects of these changes on the Air Force system are assessed.

IAF pilot training warrants analysis in light of the immediate demands placed on that system due to the country's geopolitical situation. The IAF's outstanding combat performance also suggests an effective training program worthy of closer examination. While obvious contextual differences exist, several insights emerge from a comparative analysis of the IAF and USAF programs. The IAF candidate-screening process and the composition of its instructor force are particularly relevant in light of recent changes the USAF has made in these areas, which were addressed in the previous chapter. The analysis begins closer to home, however, with a description of the US Navy's approach to training pilots.

Aviation's roots in the Navy run as deep as those in the Air Force. By 1910, the Navy had already launched an airplane from a ship. As early as 1912, in an issue of the Naval Institute *Proceedings,* Captain Washington Irving Chambers, tasked with "selling" aviation to the battleship Navy, identified several missions for naval aviation: scouting enemy ships and ports, locating and destroying submarines and dirigibles, damaging enemy installations, and improving communications between shore and fleet.[115] As with Army aviation, naval roles and missions for aircraft became increasingly diverse during World War I. During the inter-war period, carrier-based aircraft were also specialized for

[115] Amy Waters Yarsinke, *Wings of Valor, Wings of Gold,* Flying Machines Press, 1988, p. 21.

"patrol, scouting, dive bombing, and torpedo."[116] The Navy eventually established an official Training Command in the 1920s concurrent with the establishment of the Bureau of Aeronautics. Unlike the Army, however, the Navy maintained a generalized training system until World War II began.[117] This universal system cycled all students, regardless of future assignment, through progressively more advanced stages, culminating with fighter tactics and gunnery.

With the rapid increase in production necessitated by the war, however, the Navy introduced a specialized system similar to that used by the Army. Students flew a common, land-based "primary" phase, after which they were tracked into an "intermediate" phase that featured training tailored to their future combat mission. Wings were awarded after this phase. Most carrier-bound pilots then conducted carrier operations aboard the *Sable* and *Wolverine* training carriers on Lake Michigan.[118] This system served the Navy throughout the war, graduating over 60,000 pilots.[119] Specialization remained after the post-war drawdown, which reduced naval aviation to about one tenth its wartime strength, and persisted through the Cold War up to the present.

During the Cold War, the Navy's specialized system became as much a fixture in its flying culture as the generalized program had become in the Air Force. Like the Air Force, naval aviation candidates enter from one of three commissioning sources: the Naval Academy, Navy Reserve Officer Training Corps (ROTC), or Officer Candidate School (OCS). After commissioning, all prospective Navy and Marine Corps pilots begin their formal training with "Aviation Preflight Indoctrination," or API, at Pensacola NAS. This six week course involves no actual flying, but focuses on academic and physical training in "aerodynamics, engineering, navigation, aviation physiology, and water survival."[120] After completing API, students begin their actual flight training in the

---

[116] Malcolm Cagle, Captain USN, *The Naval Aviator's Guide,* US Naval Institute Press, Annapolis, Maryland, 1963, p. 16.
[117] Hill Goodspeed, Historian, National Museum of Naval Aviation, telephone interview by author, 26 April 2002.
[118] Fred Brady, Research Section, National Museum of Naval Aviation, telephone interview by author, 26 April 2002.
[119] Cagle, *The Naval Aviator's Guide,* p. 17.
[120] Richard R. Burgess, Lt Cdr USN (ret), *The Naval Aviator's Guide,* Fifth Edition, Naval Institute Press, Annapolis, Maryland, 1996, p. 57.

primary phase at NAS Whiting Field, Florida or NAS Corpus Christi, Texas.

The primary phase introduces the basics of contact, instruments, aerobatics, and formation flying in the T-34C, a single engine turboprop trainer (see Figure 11 below). During their 20 weeks in primary training, students continue academics, are introduced to simulator training, and log approximately 66 flying hours.[121] Much like the Air Force's T-37 phase, primary in the T-34C focuses on teaching fundamental airmanship and determining student capability and potential. At the end of this phase, based on service needs, flying and academic performance, and personal preference, students are tracked into their intermediate and advanced phases in one of four specialties: strike (tactical jets), maritime (multi-engine turboprop, heavy), E-2/C-2 (utility aircraft that land on carriers), or rotary-wing aircraft.[122]

The Navy's strike pipeline is the longest and most demanding. Students now fly both the intermediate and advanced stages of this pipeline, requiring nearly a full year to complete, in the newly acquired T-45A, a modified version of the British Hawk trainer (see Figure 12 below), which replaced the T-2 "Buckeye" and A-4 trainers.[123] This aircraft is, like the T-38, also being upgraded with a glass cockpit avionics suite.[124] Unlike the Air Force's T-38 Fighter/Bomber track, the naval strike pipeline, in addition to continued instrument, aerobatic, and formation training, also includes air combat maneuvering, surface attack training, and, the Navy's rite of passage, carrier landing qualification. Air Force fighter pilots receive all of their tactical training after earning their wings. This difference requires Navy students in the strike pipeline to spend a total of over one and a half years in training before earning their wings.[125] The new graduates then begin Replacement Air Group (RAG) training in their specific aircraft.

[121] Ibid., p. 59.
[122] Ibid., p. 62.
[123] Doc Watson, Cdr, USN, F-18 pilot, personal interview by author at Maxwell AFB, 9 April 2002.
[124] US Navy Fact File, Naval Air Systems Command, www.chinfo.navy.mil/navpalib/factfile/aircraft.
[125] Watson, personal interview by author

Figure 11: US Navy T-34C Primary Trainer

Source: Photo courtesy of Naval Historical Center

Students in the Navy's maritime pipeline receive an additional six weeks and 26 hours in the T-34C for their intermediate phase, focusing on instruments and navigation. Maritime advanced training follows at NAS Corpus Christi in the T-44A, a twin-engine turboprop trainer (see Figure 13 below). Students log 88 hours over approximately 19 weeks in this phase.[126] Earning their wings nearly one year after entering API, these pilots go on to fly the Navy's P-3 and C-130 turboprop variants. Pilots destined for carrier-based E-2C or C-2A assignments, also multi-engine turboprop aircraft, fly an abbreviated version of the T-44A syllabus followed by carrier qualification before earning their wings.

Figure 12: US Navy T-45A Advanced Trainer

Source: Photo courtesy Naval Air Systems Command

[126] Burgess, *The Naval Aviation Guide,* p. 72.

Finally, students destined for helicopters (comprising approximately one third of the Navy's pilots) fly the same intermediate syllabus in the T-34C as their maritime counterparts. After mastering fixed wing flying during primary and intermediate, they then complete their rotary-wing "advanced" phase in the TH-57, receiving 116 hours of instruction over 21 weeks, which includes shipboard landings, before earning their wings after a total of nearly one year in training.[127]

This long-standing, specialized system has served the Navy well and was shaped and determined by several factors. First, World War II production demands required graduating pilots to have the necessary skills to convert quickly to their specific wartime aircraft. As with the Army Air Forces during the war, any extra training was a seemingly unaffordable luxury. Second, during the Cold War, naval aviation communities crystallized broadly into jets, maritime turboprops, and helicopters. Cross training between these flying communities has always been uncommon.[128] Additionally, since the Navy, unlike the Air Force, never intended to have a large force of jet bombers or jet transports, all jet, generalized training never had the same practical or cultural appeal. Third, the time and expense required for carrier training and qualification dictated that only those pilots needing that training actually got it. Finally, the Navy was able to acquire durable, long life-cycle training aircraft well suited to their specialized operational career tracks.

The Navy's system served it well throughout the Cold War—not surprisingly, it was a frequently cited example by those advocating specialized pilot training in the Air Force.

[127] Ibid., p. 76.
[128] Goodspeed, telephone interview by author, 26 April 2002.

Figure 13: US Navy T-44A Maritime Trainer

Source: Photo Courtesy Naval Historical Center

The Air Force's late 1980s decision to adopt specialized training was just one of several converging factors adding impetus to the idea of USAF/USN Joint Specialized Undergraduate Pilot Training (JSUPT). SUPT more closely aligned with the Navy construct and, therefore, facilitated at least some degree of consolidation. Also, both services' primary, 1950s era trainers were technologically outdated and nearing the end of their service life. In the mid-1980s, the Air Force and Navy submitted independent funding requests to acquire new primary trainers. Seeing the potential for savings, Congress directed that the Department of Defense (DoD) explore consolidated pilot training and the possibility of joint procurement of a primary trainer.[129] Additionally, with the passage of the 1986 Goldwater-Nichols Defense Reorganization Act, "jointness" was emphasized throughout the DoD. Finally, the Gulf War highlighted several USAF-USN interoperability problems. While the Air Force's main interest was to acquire a new primary trainer, momentum was gathering for some form of combined training. Several precedents and examples of successful joint training programs were also readily available.

Joint training is not, of course, a new concept. The RAF, for example, trains all its Air Force and Navy pilots jointly in a specialized program remarkably similar to that of the US Navy.[130] For decades, the US Air Force has sent its helicopter pilots to joint training with the US Army at Fort Rucker, Alabama. The Air Force also trains all the Navy's maritime navigators. An even more applicable example is the successful Euro-

[129] Richard W. Stokes Jr., *Joint USN/USAF Pilot Training: An Operational Concept,* Defense Technical Information Center, Technical Report, 1989, p. 12.
[130] David Fidler, Group Captain, RAF pilot, personal interview by author at Maxwell AFB, 8 April 2002.

NATO Joint Jet Pilot Training Program (ENJJPT) at Sheppard AFB, Texas. Begun in 1980, ENJJPT conducts undergraduate pilot training for students from 14 countries and employs an international mix of instructors and supervisors.[131] Graduates go on to fly predominantly fighter-type aircraft. Lastly, for a period during the Vietnam War, the Air Force trained and graduated a significant number of Marine pilots.[132] These underlying factors and precedents suggesting the feasibility of some level of joint training were catalyzed by the services' near-term need for a new primary trainer.

The DoD's 1989 Trainer Aircraft Masterplan set in motion the acquisition of that trainer when it identified the opportunity for the USN and USAF "to replace their T-34Cs and T-37Bs with the common acquisition of a Joint Primary Aircraft Training System (JPATS)."[133] The JPATS, or T-6A *Texan* (see Figure 14 below), was named after the famous World War II era T-6, which was also a joint USAF/USN trainer.[134] The aircraft and its accompanying ground-based training devices represent a quantum leap forward in training technology that will provide optimal transferability to 21st century operational aircraft. Over 700 T-6As will eventually replace the entire Air Force T-37 and Navy T-34C training fleets by approximately 2010.[135] A 1993 joint Secretary of the Air Force/Secretary of the Navy memo estimated that common acquisition would save $575M.[136] The first group of T-6A instructors began training at Randolph AFB in 2000. The first class of students started in October 2001 at Moody AFB, Georgia.[137] JSUPT, however, actually preceded the arrival of the JPATS.

The Secretaries of the Air Force and Navy submitted a plan for joint training that was approved in October 1994.[138] JSUPT, in its present form, involves an exchange of approximately 25 instructors and 100 students per year in the primary phases at Vance AFB (in the T-37) and NAS Whiting Field (in the T-34C). Additionally, the Air Force sends about 30 instructors and150 students per year through the Navy's T-44 advanced

---

[131] Stokes, p. 13.
[132] HQ ATC/XP Memorandum for Record, "Joint USAF/USN UPT Study," October, 1987.
[133] *ORD for the Joint Primary Aircraft Training System (JPATS)*, HQ AETC/XPRU, 1 Apr 00, p. i.
[134] Ralph Monson, 12 FTW Public Affairs, *Air Force News Online,* 25 May 2000.
[135] Steve Martin, AETC/XPRU, JPATS Program Director, *JPATS Program Briefing.*
[136] "The Future of Joint Undergraduate Flying Training," AETC Initial Training Branch briefing, 21 July 1999, AETC Histories, Vol XXVI, January 1996-December 1999, p. 5, K01143250, AFHRA.
[137] "Air Force Approves JPATS Full-rate Production," Air Force News Archive, December 2001, www.af.mil/news/Dec2001.
[138] Ibid., p. 3.

Figure 14: T-6A Joint Primary Trainer

Source: USAF Fact Sheet at www.af.mil/news/factsheets

phase at NAS Corpus Christi. This has helped the Air Force maximize its pilot production because these students would have otherwise been trained in the T-1A. Approximately 20 naval students also train in the Air Force's T-1A each year at Vance AFB. Joint training squadrons generally alternate command billets on a yearly basis. The instructor and student exchanges in the primary phase cost the DOD an estimated $1.5M annually.[139] If the joint program expands as JPATS deliveries continue, exchange costs will obviously increase. The Air Force is currently assessing whether or not an expansion of JSUPT makes sense.

An expansion of the current program would actually yield few benefits. SUPT is at maximum student production (approximately 1100 per year) and has yet to actually mature as a system. More modifications and turbulence added to the structural changes already addressed in chapter four would not be beneficial. Requiring a greater number of exchange students to move in the middle of their training year also adds costs and disrupts the single base concept currently enjoyed by most SUPT students. Also, the team-oriented tradition of the pilot training class, already diminished somewhat under the SUPT construct, would be further reduced if student exchanges and moves were increased. Establishing a common operating language, building relationships to improve interoperability, developing improved joint syllabi using the best aspects of both systems, and boosting production capacity are all advantages being realized under the current JSUPT system. If USAF/USN joint programs are to increase in the future, both services

[139] Ibid., p. 4.

would reap greater benefits by increasing operational pilot exchanges between combat squadrons instead of expanding JSUPT. Exchanges at this level will produce greater real-time benefits in the event of a conflict. In sum, most of joint pilot training's aforementioned benefits can be achieved at the program's current scale; and any changes to the program have to be balanced against the need for SUPT to stabilize and mature as a system.

The IAF's pilot training program provides an excellent example of a stable and mature system with combat-proven results. For decades, the IAF's specialized program has remained largely unchanged and continues to produce superb pilots.[140] Of course, Israel's geopolitical predicament necessitates this level of quality in all branches of the Israeli Defense Forces (IDF). While the Israeli context is indeed unique, many of the principles underpinning their approach to pilot training are transferable.

One striking characteristic of that approach is the amount of time and effort expended in pre-selection and screening. Becoming an IAF pilot, particularly a fighter pilot, is the ultimate ambition for most young Israeli men.[141] This fact, and universal military service at age 18, means that the IAF, in spite of Israel's relatively small population base, has a large pool of volunteers from which to draw. Also, eliminated candidates are not lost to the system, but simply go on to serve in other capacities within the IDF. Pre-selection begins during the applicant's final year of high school (age 17 or 18). Physically qualified applicants undergo a series of written and verbal tests that assess IQ, personality, mechanical comprehension, psychomotor skills, and spatial perception.[142] Aviation medical specialists compile the results for senior officials who then interview each candidate.

Those candidates surviving this process then attend a demanding, ten-day environmental survival camp under the constant supervision of behavioral scientists and instructor pilots. Cadets must solve small-group, time-critical problems designed to measure stamina, leadership ability, stress endurance, and motivation.[143] A candidate's competitive desire and ability to handle pressure are highly sought-after attributes. While

[140] IAF homepage, "About the IAF," www.iaf.il.org.
[141] Caspi Oded, Lt Col, IAF fighter pilot, personal interview by author at Maxwell AFB, 11 Apr 2002.
[142] Norman H. Gray, "Canopy over Israel," Defense Technical Information Center, Technical Report, 1978, p. 15.
[143] Ibid., p. 17.

the US Air Force's Pilot Candidate Selection Method (PCSM, described in Chapter Three) offers reasonable predictive value for SUPT success, it measures only flying aptitude. The IAF pre-selection process, conversely, pays equal, if not greater, attention to character, motivation, and leadership traits. Following this grueling process, a full 50% of the candidates are washed out.[144] The survivors then enter the formal pilot training program. Their test scores and performance ratings carry forward and factor into their later track classification.

The formal program requires a total of two years and begins with a six-month selection phase consisting mainly of academic and military training. During this period, however, all students fly approximately ten Piper Cub sorties, in which they are evaluated on their ability to perform basic maneuvers and maintain headings and altitudes.[145] Their flight instructors are all experienced military pilots (mostly reservists) quickly able to determine a student's flying potential. This phase typically eliminates 40-50% of the students who entered the selection phase.[146] Survivors remain in the pilot pipeline, while those eliminated enter navigator or non-flying tracks. Prospective pilots then begin an additional six months of intense ground school emphasizing officership and military education.

Upon completion of ground school, one year after entering formal training, all cadets begin primary flying in the Tzukit jet trainer, a modified, fully-aerobatic French aircraft (see Figure 15 below). All Tzukit instructors are experienced operational fighter pilots. At the end of primary, after approximately 15 sorties and a check ride, a final track determination is made. Yet another round of attrition also sends some cadets into the navigator pipeline. Surviving cadets are placed into one of three tracks—fighter, transport, or helicopter—based on their Tzukit performance and total military record. Attrition after this track decision remains low for the remainder of the program.[147]

Transport and helicopter candidates proceed on to their respective basic and advanced phases, which use training aircraft tailored to their future operational missions. Fighter candidates remain in the Tzukit for an additional 4-5 months for their basic phase.

---

[144] Oded, interview by author.
[145] Ibid.
[146] Gray, p. 18.
[147] Oded, interview by author.

Following basic, fighter candidates complete their final six months with advanced training in the TA-4, a modified, two-seat attack jet.[148] All newly winged pilots in the IAF then go to transition training for their operational aircraft. Significantly, none are retained for instructor duty. Typically, pilots return as instructors after at least one operational assignment. Israel does employ some reservists as instructors—these individuals serve for approximately two week intervals, however, to facilitate continuity with students.[149]

The IAF, like the U.S. Navy, provides another example of a successful, long-standing specialized training system. Specialization is well-suited to the IAF's rated force structure—cross-training between operational pipelines is, not surprisingly, quite rare.[150] The IAF leader-

Figure 15: IAF "Tzukit" Trainer

Source: Photo courtesy IAF Homepage

ship also understands that, beyond producing technical operators, they are also selecting and molding their future combat leaders. The cadet's capacity and potential for military leadership is scrutinized throughout the program. Initiative is inculcated and rewarded at all levels, and the warrior-leader ethos permeates every facet of the IAF system. This emphasis is manifest in the operational focus and experience level of the IAF's instructor force. That aspect of their system is particularly relevant to the USAF in light of the

[148] Ibid.
[149] Ibid.
[150] Ibid.

structural changes addressed in the previous chapter. As the Air Force continues searching for ways to cope with its pilot shortage, the IAF's system provides a useful reminder that the importance of operationally-experienced, dedicated instructor pilots as mentors and role-models cannot be overstated.

Also relevant to the USAF are the IAF's candidate selection methods. Some recent trends among SUPT students and graduates suggest that the USAF could benefit from a more strenuous pre-selection process. The door to SUPT, it must be remembered, also represents the Air Force's primary leadership entrance. A wealth of anecdotal evidence suggests that today's SUPT students and graduates do not, in general, have the same aggressive attitude and martial spirit that characterized those in years past.[151] In a striking statistical change, T-37 self-initiated eliminations have risen rapidly in recent years, frequently outnumbering those eliminated for flying deficiencies.[152] Accurately determining the causes of this phenomenon (if it indeed constitutes one) exceeds the scope of this study. Nevertheless, the effect on the caliber of SUPT entrants could only be positive if the Air Force applied some of the IAF's pre-selection principles to its own selection mechanisms. As mentioned in chapter four, a portion of the savings realized through the low-cost IFT program could be wisely used for this purpose.

[151] Multiple telephone interviews by author of instructors at Vance AFB, Columbus AFB, and follow-on training units for both heavies and fighters, 2002.
[152] AETC, FY 2001 "Flying Training Attrition" Briefing, Allocations and Assessments Branch.

Chapter 6
Conclusion

At its outset, this study posed several strategic questions concerning the Air Force's pilot training system. This concluding chapter summarizes and synthesizes the answers to those questions and describes their implications for what is arguably the Air Force's most important training program. The conclusions fall broadly into the three categories identified in the study's alliterative title, "Men, Machines, and Methods for Training Military Pilots" (of course, the term "men" in this case represents the gender-neutral, human element of pilot training).

Regarding method, in its turbulent first 50 years, Army and Air Force pilot training established a long-standing precedent of and preference for specialization. Diverse roles and missions for aircraft, such as pursuit and bombardment, emerged very early in airpower's history. These missions required aircraft with increasingly specialized designs and performance characteristics. Pilots, in turn, needed specific skills and training in order to operate them. Determining the optimal point along the training continuum to begin mission-specific training was problematic but necessary and perhaps inevitable. Also, the World Wars' staggering production demands necessitated that new pilots be deployable shortly after earning their wings, thereby requiring a deeper specialized taproot.

The availability of suitable training machines, however, largely determined the method used and the degree to which a specialized system could actually be implemented. In fact, the lack of a suitable heavy trainer to replace the TB-25 was actually a significant factor in the Air Force's late 1950s decision to implement generalized, all-jet UPT. Similarly, SUPT's early 1990s implementation was contingent on the Air Force's acquisition of a new transport-type trainer, the T-1A. More recently, the services' common need to replace their T-34C and T-37 primary trainers led to the joint acquisition of JPATS and the introduction of joint training into their respective programs.

As described in Chapter Three, the arrival of UPT's generalized method was nearly coincident with the Air Force's adoption of ISD as its official construct for

designing training programs. Underlying tension between ISD and generalized UPT, T-38 life cycle concerns, and the potential to realize large cost savings eventually led the Air Force to acquire the T-1A and establish SUPT. This study concludes that specialized pilot training more closely aligns with ISD principles, saves the Air Force money, is inherently more capable of satisfying the disparate needs of gaining operational communities, and does not adversely affect force structure flexibility. SUPT is still a young system, however, and in the short time since its inception, its maturation process has been interrupted by a series of structural changes precipitated by external events and conditions. Chapter Four examined the genesis and effect of significant changes to two areas in particular: the flight screening process, and the composition of the SUPT instructor force.

After grounding its entire T-3A fleet in the aftermath of several mishaps, the Air Force screening program was in disarray for over one year. This study did not judge the soundness of the Air Force decision on the T-3A, but rather traced flight screening's evolution in the Air Force, described its effects on pilot training attrition, assessed the efficacy of the current Introductory Flight Training (IFT) program, and determined whether a change was needed. Direct statistical correlations between various screening programs and pilot training attrition rates are difficult to establish (due to the multitude of variables involved). Nevertheless, this chapter concluded that flight screening programs, in general, have a positive effect on attrition and are a wise investment for the Air Force.

The IFT program itself was found to be a simple, effective, and low-cost replacement for the T-3A's more demanding EFSP construct. In an ideal world, the Air Force would have a military-operated enhanced screening program in a more capable trainer. However, the added benefit of such a program does not presently warrant an effort to re-acquire a fleet of enhanced trainers or to re-train a cohort of military instructors. Too, that which originally gave impetus to the EFSP concept—the idea of making the student's track determination before SUPT—was never instituted. IFT costs less than 40% of what EFSP did. The Air Force should invest a portion of these savings to improve its pilot recruitment and selection programs. Finally, preciously scarce military instructor pilots could, at present, be more profitably used to address manning problems in SUPT itself.

These same pilot-manning problems catalyzed the recently implemented ARC program, another significant structural change to SUPT. This creative initiative has, in fact, captured the experience of many separating active-duty pilots for at least part-time duty and mitigated the impact of the pilot exodus and manning crisis. This study found the Air Force, however, largely dismissive of this program's less beneficial aspects. A large population of part-time instructors not under the command of the flying squadron commander causes continuity problems and a more disjointed training atmosphere. Active-duty instructors with recent major weapons system experience are pivotal in the process of mentoring and molding military pilots. Presently, part-time reservists and First Assignment Instructor Pilots (FAIPs) represent the majority of T-37 instructors. There is virtually no fighter presence in SUPT's T-37 squadrons. While perhaps understandable given present manning constraints, cuts in these areas have an associated price. The Air Force has begun turning the corner with its pilot shortage. As that situation improves, Air Force leaders must make the strategically hard, but wise decisions to improve the composition and operational focus of the SUPT instructor force. If reservists are to remain a part of that force, only experienced, full-time Reservists should be used. The role and importance of dedicated, experienced instructors—the men—in SUPT's future success cannot be overstated.

Findings in Chapter Five reinforced this conclusion. This chapter broadened the analytical scope by analyzing the US Navy and Israeli pilot training systems. Both of these systems provide additional examples of long-standing, effective specialized systems. The Navy's program developed separately, but in parallel with the USAF system under similar contextual influences. Significantly, this separation ended recently with the introduction of joint pilot training (JSUPT), and the joint procurement of a common primary trainer, the T-6A. After analyzing the benefits and drawbacks of JSUPT, this chapter determined that the program's benefits can be realized at its current, modest scale, and that operational pilot exchanges would be a better method to improve combat interoperability. Furthermore, any additional changes to SUPT must be balanced against the preferability of keeping students at a single training site, and the need to stabilize what is still a maturing system. Finally, the T-6A will be an excellent replacement for both services' primary trainers, providing a solid training platform well

into the 21st century.

An analysis of the IAF's system also illuminated several valuable insights. Two areas emerged—both relating, again, to the importance of men in the training equation—as particularly relevant to the USAF. The rigors of Israel's pre-selection process ensures only the very best enter training. That same process regards leadership potential at least as highly as a candidate's aptitude for flight. The Air Force should invest some of the savings generated from IFT and SUPT to improve its own pre-selection mechanisms—the door to SUPT is also its primary leadership entrance. The IAF understands this fact quite well. Their instructor force, consisting solely of operationally-experienced pilots, recognizes and rewards leadership and initiative at all levels of training. They also strive to imbue their students with the warrior ethos. Of course, geopolitical necessity and a very proximate external threat fuel this process. While not sharing the same contextual imperatives, the USAF could only benefit by applying some of the IAF's training principles to SUPT.

With recent T-38 upgrades, and the acquisition of JPATS and the T-1A, the Air Force has a solid fleet of training machines to support SUPT's specialized method well into the future. The single most important factor in SUPT's future success, however, is not machines or methods, but men. Indeed, the quality of pilot candidates and the character of SUPT instructors will largely determine SUPT's success. If led and managed properly, the Air Force's most cherished training program will continue to produce superb pilots and leaders to ensure its dominance well into the 21st century.

BIBLIOGRAPHY

Anderson, Hurd, Paul M. Matthews, Arthur R. Meacham, John R. Rundell, Jr., Ray L. Russell. *Multi-track Undergraduate Pilot Training: An Analysis.* Research Paper. May 1975. AUL DOC M-U35582-7 A5494m.

Arnold, Henry. *Global Mission.* Harper, New York. 1949.

Bache, Bradshaw, Lee R. Cook, Leslie A. Hobgood. *Candidate Selection for Parallel Track Undergraduate Pilot Training.* Research Paper. April 1978. AUL DOC M-U43117 B119c.

Beale, Robert S. *Pilot Training and Operational Training in the Israeli Air Force.* Air War College Professional Study. April 1972. AUL DOC M-U32983 B3663p.

Braybrook, Roy. "Teaching Tomorrow's 'Drivers'." *Armada International* (June-July 2001): Vol. 25 no. 3.

Cameron, Rebecca Hancock. *Training to Fly, Military Flight Training 1907-1945.* Air Force
History and Museums Program, 1999.

Cook, James A. *Quantity or Quality: An Analysis of Current UPT Philosophy.* Research Paper. January 1972. AUL DOC M-U32983 C7718q.

Corrigan, Terence. *UPT: A Look into the Future.* Research Paper. May 1974. AUL DOC M-U35582-7 C8251u.

Creech, Wilbur L., General, USAF. Letter to USAF Commander, General B. L. Davis concerning SUPT with attached synopsis of program. 13 Feb 1980. 168.7339-214 AFHRA.

Dean, Lankford, Ralph Miller, Richard Overton. *Specialized Undergraduate Pilot Training: TTB Training Requirements.* Air Force Human Resources Laboratory Research Study. August 1980. AUL DOC M-U 42583 no. 80-9.

Dixon, Malcolm R. *SUPT: Should TAC Get on Board?* Research Paper. April 1987. AUL DOC M-U43122 D6213s.

Dorfler, Joseph F., Maj, USAF. *The Branch Point Study: Specialized Undergraduate Pilot Training.* Airpower Research Institute. June 1986. Air University Press, Research Report No. AU-ARI-86-5. K239.0425-26 AFHRA.

Gorrell, Edgar S. *The Measure of America's World War Aeronautical Effort.* Lane Press,

Burlington, Vt., 1940.

Gray, Norman H. *Canopy Over Israel: Eyewitness Reports on the Selection, Training, and Assignment of Personnel in the Israeli Air Force.* Naval Sea Support Center. San Diego, CA. 1978.

Harrison, James W. *Crew Coordination: Its Application in Dual Track UPT.* Research Paper. May 1979. AUL DOC M-U43122 H319c.

Huskey, Richard L. *Undergraduate Pilot Training—the Tailored Approach.* Research Paper. May 1975. AUL DOC M-U35582-7 H971u.

Kermeen, John J. *Future UPT.* Research Paper. May 1980. AUL DOC M-U43122 K39f.

Keyes, Ricky J. *Cockpit Resource Management, A New Approach.* Airpower Research Institute. K239.0425-26 90/01/11, in AFHRA.

Lahm, Frank P. *Training the Airplane Pilot.* Journal of Royal Aeronautical Society, Nov 1933, 167.401-4, AFHRA.

Martin, Raymond C. *Instructional System Development (ISD) and Specialized Undergraduate Pilot Training (SUPT).* Research Paper. May 1975. AUL DOC M-U35582-7 M3824i.

Maurer. *Aviation in the US Army, 1919-1939.* General Histories, USAF Historical Research
Center, Washington D.C., 1987.

Oaks, Robert C. "SUPT: Realistic Training to Match Pilot Skills." *TIG Brief* (Sep-Oct 1989): 41:23.

Shaud, Lt Gen, USAF. "Shaping Tomorrow's Air Force Today." *Illustrated Air Force Magazine* (December 1987): 70: 48-52.

Vrettos, John D. *SUPT—Impact on Assignment Flexibility.* Research Paper. May 1980. AUL DOC M-U43122 V979s.

Walker, Lois, and Wickam, Shelby. *From Huffman Prairie to the Moon: The History of Wright*
Patterson Air Force Base. Air Force Logistics Command. K289-92.158, AFHRA.

Walters, Brian. "Pilot Training—Current Options." *Asian Defence Journal* (July 1991): 7: 64-70.

Westback, Eugene O. *An Analysis of Specialized vs. Generalized Approaches to UPT.*

Research Paper. May 1972. AUL DOC M-U35582-7 W5232a.

Air Force Manual 50-2. *Instructional System Development (ISD).* 1970.

Future Undergraduate Pilot Training (UPT) Study. Lockheed Company, Prepared for AF Systems Command. Wright-Patterson AFB, OH. February 1971.

Future Undergraduate Pilot Training (UPT) Study. Northrop Corporation, Prepared for AF Systems Command. Wright-Patterson AFB, OH. March 1971.

Mission Analysis on Future Undergraduate Pilot Training: 1975-1990. AF Systems Command Study. Randolph AFB, TX. 1972.

Concepts and Programs for Future UPT. Air Training Command History and Research Division Historical Monograph. September 1975. K220.04-37. AFHRA.

Comparison of UPT Generalized vs. Specialized. HQ Air Training Command. December 1975. ATC History. K220.01 V. 7. AFHRA

United States Air Force Trainer Masterplan. DAF Pamphlet. March 1988. File from CSAF Staff Group. K168.03-2152 or IRIS no. 01136850. AFHRA.

Track Selection System for SUPT: Full Scale Development Plan. Human Systems Division History. October 1987-September 1988. K237.01 V.5. AFHRA.

Flying Training. Chapter IV of Air Training Command History, January 1991-November 1991. K220.01 V.1. AFHRA.

ATC Programming Plan (PPLAN) 3-88, SUPT and PCSM Implementation Master Plan. Prepared by HQ ATC/XPPX. 15 January 1992. K220.01 V.26. AFHRA.

Specialized Undergraduate Pilot Training. Air Training Command History, January 1992-June 1993. K220.01 V.1. AFHRA

Next Generation UPT Briefing. Briefed at 23 October 2001 Corona Conference. Details proposal for a return to more generalized form of UPT. From HQ AETC/DOFI.